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FIRST PART.
ORIGINAL ARTICLES

Present Status of Agricultural Education in Canada

by

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JURISDICTION OF THE FEDERAL AND PROVINCIAL GOVERNMENTS.

By virtue of the British North American Act passed by the British Parliament under which the provinces become a federation known as the Dominion of Canada, concurrent power of legislation with regard to agriculture is exercised by the Federal and Provincial Parliaments. The Federal Parliament may make laws concerning agriculture in any or all of the Provinces, and any law of the legislature of a Province relative to agriculture shall have effect in and for the Province so long as and as far only as it is not repugnant to any Act of the Parliament of Canada.

Education in its restricted sense, including the teaching of agriculture in the schools, is the exclusive prerogative of the Provincial Governments. However, in its broader sense of educational agencies other than the regular schools, concurrent power is exercised by the Dominion and Provincial Governments. Sometimes, moreover, there is a certain measure of collaboration between them.

THE AGRICULTURAL INSTRUCTION ACT, 1913.

The passing of the *Agricultural Instruction Act* 1913 by the Dominion Parliament during its last session, at the instance of the Minister of Agriculture, Hon. MARTIN BURRELL, is the most momentous event that has occurred in the history of agricultural education in Canada in recent years. From it a great impetus for agricultural education has been generated. This encouragement lies in the favorable sentiment awakened by the Federal Parliament's action perhaps as much as in the generous vote of money.

By the terms of the Act the sum of \$10,000,000 is set aside for distribution amongst the provinces during the next ten years on a *pro rata* of population basis. While the expenditure of the provincial grants is entirely in the hands of the provincial authorities, the approval of the Federal authorities is first necessary for any proposed outlays.

No restricting provisions appear in the Act. Any commendable line of effort that the provincial Departments of Education and Agriculture may desire to carry out will be supported. It aims to strengthen all lines of instructional and educational work already under development. Many of the undertakings mentioned below as being carried out by the different provinces have been initiated or are being made possible of development because of the support of this Act. In every part of Canada its influence is being felt.

INSTRUCTION THROUGH AGRICULTURAL ORGANIZATIONS.

It is rather difficult to define the term "agricultural instruction". Ordinarily the word "instruction" is restricted to the work of schools and teachers, but in agriculture other agencies may be and often are considered as educational agencies. These agencies are more numerous perhaps in the Province of Ontario than in the other provinces of Canada although they are more or less represented in them all. Their objects are educational; they seek to promote some particular branch of agriculture or farm life through shows, competitions, annual meetings, printed reports and courses of lectures. They are designated as Associations, Societies, Institutes and Unions. Of those called Associations there are the Vegetable Growers', Fruit Growers', Bee Keepers', Corn growers', Cattle Breeders', Sheep Breeders', Swine Breeders', Horse Breeders' and Dairymen's. Of those called Societies there are Agricultural, Horticultural and Entomological. Of the Institutes there are the Farmers' Institutes and the Women's Institutes. The Agricultural and Experimental Union is another educational organization. All of these receive funds from the provincial treasuries and are under the supervision of the Departments of Agriculture. Besides these organizations, numerous Farmers' Clubs, and Boys' and Girls' Clubs have come into existence within the past few years and may be considered as educational factors in agriculture. There are very few parts of the country where at least one of the organizations is not represented. Their membership is made up of the most progressive people as a rule although there are still many people to be reached by them. Demonstration trains too have in recent years taken instruction and demonstrations to the farmers; they are operated jointly by the railroad and the Departments of Agriculture.

Under the support of the Dominion Department of Agriculture there are other organizations doing educational work such as the Dominion Experimental Farms, the Dominion Seed Growers' Association, the Forestry Association and Cow-Testing Associations. Some of the different branches of the work of the Department are under the direction of special officers called Commissioners. There are a Live Stock Commissioner, a Seed

Commissioner, a Dairy and Cold Storage Commissioner. It has also a special Publications Branch which looks after the publication and distribution of all reports, bulletins and circulars.

These organizations and officers of the Dominion Government work hand in hand with the Provincial organizations and officers. Their work is carried out so as to supplement and help and not to overlap the provincial work. There is friendly co-operation along all lines. The Experimental Farms located at strategic points throughout the Dominion, besides teaching thousands of farmers by actual demonstrations, distribute valuable planting material and reports, and send out members of their staffs to lecture at farmers' meetings. The Seed Growers' Association, besides training its members in the growing of selected seed, further serves the farmers' interests by securing and distributing such seed. The Dairy and Cold Storage Branch organizes and supervises Cow Testing Associations throughout the Dominion, being assisted in this by the provincial authorities. The Seed Branch looks after the administration of the *Seed Control Act* through which farmers are protected from impure seed; in its laboratories, seed for planting is tested for purity and germibility and reported upon to the individual farmer. The Live Stock Branch serves in its own field in all the different provinces.

In every phase of its activity the work of the Dominion Department of Agriculture is educational. It has taken no small share of the work of instructing Canadian farmers in scientific agriculture. As time goes on its work increases.

Ontario.

In the Province of Ontario, there is at the head of the schemes for agricultural education, the Ontario Agricultural College located at Guelph. It has been in operation for thirty nine years. In 1902 the Macdonald Institute was established and made part of the College. In this there are Departments of Home Economics, Manual Training and Nature Study organized to train teachers and to promote these subjects in the schools, and in the case of the Home Economics Department to give to girls from the farms training in cookery, sewing, laundry work, etc. The Ontario College is the mother amongst the Agricultural Colleges of the Dominion. The other Colleges resemble the parent college in many of their features.

The regular work in Agriculture has two aims or conclusions. Students attending two years receive diplomas as Associates of the College; the work is adapted as far as possible to the practical needs of the farmer in his everyday work and problems. A further attendance of two years leads to a graduation as a Bachelor of the Science of Agriculture (*B. S. A.*) granted by the Provincial University. The last two years' work takes the student further into the scientific study of the subject. The College constitutes part of the University of Toronto.

Much instruction is given in short courses. These are held throughout the year. They include a three months' course for cheesemakers and buttermakers (another Dairy School serving the eastern part of the Province

is located at Kingston), a two weeks' course on seed and cattle judging, a four weeks' course in poultry keeping, two weeks' course in fruit growing and bee keeping, a ten weeks' spring course for Normal teachers, three months' courses in domestic science and domestic art, five weeks' courses for public and high school teachers, besides shorter courses for school inspectors, judges of field crop competitions, milk inspectors, ice cream manufacturers and travelling dairy instructors. In the month of June the College is given over to the entertainment and instruction of thousands of members of Farmers' Institutes which arrange excursions.

During the past six years there has been a marked growth in the work of the so-called District or County Agricultural Representatives. From six appointed in 1907, the number has grown to thirty-seven. These young men are all graduates of the Agricultural College, holding the degree of B. S. A. From central locations in their counties they carry on many diverse lines of activity. These include holding short courses in the local High Schools, teaching elementary agriculture to the regular High School classes, holding seed and stock judging courses out in the country, organizing Farmers' Clubs, Township School Fairs, Egg-Collecting Circles, Pure Seed Clubs for growing, selling or buying improved seed, visiting farmers on their farms, teaching lessons in country schools, carrying out co-operative experiments on fertilizers, demonstrating modern orchard management, lecturing at Farmers' and Women's Institute meetings, making drainage surveys for farms.

In the elementary schools the teaching of agriculture has been making satisfactory advances. It is under the charge of an officer of the Department of Education designated as the Director of Elementary Agricultural Education. No text book is prescribed; the work is based on Nature Study and School Gardening. Teachers are specially trained in spring and summer courses at Guelph receiving the *Elementary Certificate in Agriculture*. Special grants are paid to teachers and trustees undertaking the work. The work is optional but public sentiment in favor of it is growing steadily. One hundred and eighty schools entered for the work in 1913 to qualify for the special grants. Many other schools are conducting school gardens and giving some instruction in agriculture without engaging to fulfil all the requirements for the special grants. Through the Schools' Division of the Experimental Union, choice planting material is furnished free to the schools for experimental and demonstration purposes. During the past season Field Agents in Agricultural Education assisted the Director of the work in supervising and inspecting the work in these schools, besides giving instruction at Teachers' Institutes and the Model Schools where teachers are trained. At the Normal Schools also, teachers receive instruction in Elementary Agriculture and School Gardening.

In the High Schools besides the short courses given by the County Agricultural Representatives a commencement has been made this year to introduce agriculture as a regular subject along lines similar to the Public School work. Teachers are specially trained for the service at a summer school held at Guelph, receiving the *Intermediate Certificate in Agriculture*.

Special grants are given to them and to the trustees. Two schools have commenced the undertaking. The subject is optional but an examination is held on it and the marks obtained added as a bonus on teachers' qualifying certificates.

Quebec.

In Quebec, Macdonald College located at Ste. Anne de Bellevue, near Montreal, stands at the head of the schemes for agricultural education, particularly for the English speaking population of Quebec. Besides this, there are smaller French colleges located at Oka and Ste. Anne de la Pocatière. The Agricultural Institute of Oka, as it is called, is affiliated with Laval University and gives a four year course leading to the degree of B. S. A.; it is in charge of the Trappist Monks, four or five of the fathers or brothers being professors in the school. The school at Ste. Anne is of more recent establishment than that at Oka.

Macdonald College is affiliated with Mc Gill University and graduates receive from it the degree of B. S. A. after a four years course. As in the Ontario College, there is a two years course for the Associate Diploma. A School of Domestic Science and a School for Teachers are comprised in the College. The School for Teachers takes the place of the McGill Normal School which formerly carried on the teacher-training work for the English schools. Within the past year arrangements have been made whereby agricultural students of the two or four years courses, by taking special instruction in pedagogy and practical teaching, receive certificates entitling them to teach in the English rural or urban schools. A special propaganda has been carried on also aiming at the consolidation of rural schools. Besides training teachers in agriculture, the College also issues leaflets on agricultural topics for use by the pupils in the rural schools.

District, or Agricultural, Representatives carrying on work similar to that in Ontario have been appointed in Quebec also. Six of these are under the charge of Macdonald College, and five are working amongst the French population and connected with the Provincial Department of Agriculture.

In the French elementary schools instruction is given in agriculture by means of a text book, "*L'Agriculture dans les Ecoles*". This has been in use for about eighteen years. In some localities school gardening has been commenced under the encouragement of the District Representatives in some cases. For 1913 there were 234 schools located in 53 counties reported as carrying on this work. In further support of the introduction of the subject it is proposed to give students attending the Normal Schools theoretical and practical training in such branches as dairying, poultry-husbandry and horticulture, also to encourage teachers and schools to take it up by offering special grants of money.

Nova Scotia.

In the Province of Nova Scotia, the Agricultural College located at Truro, stands at the head of the work in agricultural education. Besides Nova Scotia this College has been serving the needs of the two other

maritime provinces of New Brunswick and Prince Edward Island. The work carried on corresponds to the first two years for associate standing at the Macdonald College and Guelph and accredited graduates are admitted to the third year work of these larger Colleges.

The provincial Normal College, also located at Truro, is closely associated with the Agricultural College, and teachers-in-training have the advantage of instruction from members of the College Staff. A special faculty has been organized for the training of teachers for service in "Rural Science Schools". At such schools gardening is carried on under teachers holding the *Rural Science Diploma* in whole or in part. Special grants are paid to teachers and trustees for the work, the amount depending on the grading of the schools' effort as "fair", "good", or "superior". A Director of Rural Science Schools has been appointed to supervise the work throughout the province. For teachers actively engaged in teaching, a Summer School is held at the Agricultural College to train candidates for the Rural Science Diploma. Thirteen teachers from New Brunswick attended the School in 1913, receiving special grants from the Government to cover part of their expenses.

New Brunswick.

For the Province of New Brunswick the instructional needs in agriculture have been met hitherto by the Nova Scotia Agricultural College at Truro. During the past year, however, the Fisher Vocational School has been built at the town of Woodstock and through its agricultural department a commencement will be made early in 1914 with short courses in agriculture. This school has been built under a bequest but the expense of conducting the institution will be met by the Government. Besides the winter short courses, a Rural Summer School will be held at the Woodstock School in July. This will be for the purpose of training teachers in School Gardening and Elementary Agriculture. Those who put their instruction into successful practice afterwards in their schools will receive special grants therefor. The agricultural work in the schools is in charge of the *Director of Elementary Agricultural Education*. Besides the school at Woodstock, another agricultural school is planned for the southern part of the Province, at Sussex.

Prince Edward Island.

During the year 1913 agricultural instruction in Prince Edward Island has developed chiefly in connection with Prince of Wales College. A winter short course in Agriculture for farmers was carried out at the College, including Domestic Science instruction for farmers' wives and daughters. The regular students at the College receive instruction in Agriculture also; this is given by members of the staff of the provincial Department of Agriculture. There is also a Summer School for Teachers held at the College, training in School Gardening and Elementary Agriculture.

Two District Representatives are members of the staff of the Department of Agriculture, one serving the Island west of Charlottetown and the other the eastern part.

Manitoba.

In the Province of Manitoba the Agricultural College having outgrown the quarters originally provided for it, took possession of its new and enlarged quarters on a new site near Winnipeg. The new College is planned on a magnificent scale. No expense has been spared to provide the very best of equipment and buildings. During the first term over 300 students enrolled and it is expected that this number will be increased largely. At this College all teachers from the provincial Normal School receive a month's training in Agriculture, either before or after the regular normal training.

The agricultural work of the schools is under the direction of an officer of the Department of Education designated as *Director of Elementary Agriculture, School Gardening and Nature Study*. School garden work and the teaching of agriculture are compulsory in the schools.

In 1912 Agriculture was introduced into one of the High Schools under a special teacher, a graduate of an Agricultural College. This year there are five schools with Agricultural Departments, in charge of such teachers. This number will soon be increased. These teachers serve under the Department of Education but otherwise carry on work similar to the Agricultural Representatives in other provinces.

Under the Extension Service of the College, Children's Club work is promoted.

Saskatchewan.

The provincial College of Agriculture for this Province is located at Saskatoon. In 1912, the first year of its operation, there were sixty-four students in the first year of the certificate course. For the fall term of 1913 it was expected there would be a total enrolment of about one hundred and twenty students in Agriculture.

In the schools the subject of Agriculture is prescribed for Grades VII. and VIII. and also for the grade VIII. diploma which is the high school entrance requirement. For a third class teacher's diploma the subject is compulsory. There is no text book prescribed by the authorities; instead there is a list of recommended reference books for the teacher's use.

Steps are being taken to provide for the training of teachers in Agriculture at the two provincial Normal Schools as well as at the Agricultural College.

For the promotion of agriculture throughout the Province, Agricultural Secretaries are appointed by the municipalities. Amongst other duties they act as weed inspectors. There are about eighty of these officers at the present time. They are especially instructed in short courses at the Agricultural College. When the proposed Agricultural Representatives are appointed these Secretaries will likely serve under them.

Alberta.

The Province of Alberta has proceeded in its development of Agricultural Education along lines different from those followed in most of the other

provinces. Instead of commencing with an Agricultural College, provincial *Schools of Agriculture* have been organized. In 1913, three of these began operation; they are located at Vermilion, Olds and Claresholm, separated thus to serve three more or less dissimilar districts. The instruction covered corresponds to the first two years of the Manitoba or Ontario Agricultural College. Domestic Science is taught in addition to Agriculture. It is expected that more schools will be started and, as the work develops, an Agricultural College will be established as a part of the Provincial University, completing the course of instruction in Agriculture for the degree of B. S. A.

The work in the schools is encouraged also along lines somewhat similar to those followed in Saskatchewan. A Summer School to train teachers was held in 1913 at the University of Alberta, Edmonton. Eighty-five teachers were in attendance. This will be continued and extended. The Legislature has made provision for special grants for the encouragement of agriculture and school gardening. With these two factors in operation rapid advancement of agricultural teaching is expected.

British Columbia.

Up to the present there has been no school or college of agriculture established in British Columbia. The question of the establishment of an Agricultural Department in the provincial university now under process of organization is receiving favorable attention, however.

In the schools there is no definite work prescribed other than the encouragement of school gardens and Nature Study. In some places the local Women's Institutes are assisting teachers in the gardening work. The Department of Education is planning for an extension of the work in both the public and high schools and will submit a bill to the Provincial Legislature for this purpose in the first session of 1914.

In furtherance of the fruit interests the Department of Agriculture has seven Assistant Horticulturists located throughout the province acting in somewhat the same capacities as the Agricultural Representatives of the other provinces. Their work is confined, however, to horticultural interests; they do not take any work in the schools.

Present State of Agricultural Education in Germany

by

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There are three kinds of institutions in Germany which deal with agricultural education:

- a) Academic institutions in which research work is also conducted.
- b) Secondary agricultural schools.
- c) Primary agricultural schools.

Besides the above there are a large number of local continuation schools, schools of domestic economy, travelling lecturers and continuation courses for the spread of general and special knowledge in agriculture and domestic science and their allied branches.

In view of the available time and space it has been impossible to give figures for the whole of Germany. Therefore only the principal statistical data relating to agricultural education in Prussia and, as far as possible, the number of the various educational institutions in the other German states of the confederation, have been given in *Table I*. It should be pointed out that, owing to uncertainty of some of the material and to the nomenclature of the schools being frequently different in the various States, errors may have crept into the classification of individual schools. The table shows the numerical prevalence of secondary and primary schools corresponding to the greater number of medium and small sized farms. These absolute figures, however, unaccompanied by the numbers of the farms of different sizes etc. do not give much information as to how far the educational requirements of the various classes of farms are provided for. It can safely be assumed, however, that the primary and secondary schools are still far from being sufficiently numerous.

The establishment of secondary and primary agricultural schools was taken in hand much later than that of academical agricultural institutions, and for this reason they do not yet meet the demand everywhere. At least 78 per cent. of the cultivable area of Germany is cut up into small farms for the holders of which the secondary and primary schools are the most suitable. It would therefore be most important to increase still further the lower grade schools in order to increase the production of the largest portion of the surface of the country. To the same end it would be advisable to increase the number of travelling lecturers and of demonstration fields which induce smaller farmers to adopt recent improvements by means of object lessons.

The introduction and rapid development of instruction in domestic economy is very satisfactory, as good domestic management on the part of the women is an essential factor of the financial success of the whole farm, especially in medium sized and small holdings. In this connection also further progress is very desirable.

Academical instruction and research has undergone many transformations during the last two centuries. It is at present an organised study in the curriculum of the great centres of learning, especially the Universities. At the same time agriculture appears also as a section of a technical college (Munich) and in independent colleges (Berlin and Hohenheim), and also in the form of agricultural academies (Poppelsdorf and Weihenstephan). Of late an experiment has been made besides in Bromberg, of creating a seat of higher agricultural research on American lines where continuous instruction is not obligatory.

Which of these forms is the best is still an open question as each of them has its advantages and disadvantages. From a purely financial point of view, independent colleges appear to be the most expensive form of

academical agricultural education, but this of course is no decisive argument as many other weighty factors have to be considered.

With regard to the secondary schools, an experiment has lately been made in Prussia with a new form of school, the agricultural seminary, probably because the older schools have not adequately filled the gap between lower and academical education. Whether these new intermediate schools will give good results and eventually supplant the older schools, cannot yet be foreseen.

The general and special courses of continuation lectures for farmers similar to those long held for other professions. *i. e.* medical men, school-masters etc. enjoy increasing favour. They also give older farmers the opportunity of becoming acquainted the recent progress in agricultural science with the least expenditure of time and money.

In order to give some numerical data on the institutions of different degrees of agricultural education in Germany, on the cost of their upkeep and the number of students enrolled, the principal figures for Prussia are given in *Table II*. They have been kindly furnished by Prussian Ministry of Agriculture from the statistics of agricultural education in Prussia for 1909-1911 which are still in the press. In this table, the academical and research institutions are arranged according to their age. It shows the numbers of students and the results of examinations during the last 12 years. It will be seen that Halle and Göttingen are more popular amongst Germans other than Prussians and amongst foreigners than the other centres of education, and further, as appears natural from their geographical position, that Breslau and Königsberg also attract foreigners to a certain extent while the attendance of Germans other than Prussians is strikingly low. In order that the examination results should be comparative they should be expressed as percentages of the students during the periods under consideration but the material is insufficient to do this. From the statistics it appears also that the attendance at the Berlin college is by far the highest of all the academical institutions of Prussia both absolutely and relatively and the examination results testify to the diligence of the students.

The independent agricultural colleges are heavily handicapped compared with agricultural faculties of universities or technical college by not possessing the right to grant doctor's degrees, and, if the question it to be solved as to which form of academical education is most suitable and successful for agriculture, it would be necessary to place the independent agricultural colleges on an equal footing with the universities and technical and veterinary colleges such as the "Hochschule für Bodenkultur" at Vienna, with regard to entrance examinations and to the standing of the final diploma or degree.

Table III gives a general account of the running expenses of the academical institutions for agricultural education and research for the year 1910, the latest year for which material is available. It shows that the faculty of agriculture at Kiel has still remained quite undeveloped, and that at Breslau salaries are a relatively important item compared to other universities owing to the budget being charged with a number of pensions.

The table further confirms the statement made above, that independent agricultural colleges require larger contributions from the State than agricultural faculties attached to larger scientific centres, because the former need a special staff and equipment for each auxiliary science which is unnecessary when the agricultural faculty is attached to a university or technical college.

It is impossible to judge of the value of the academical education from the statistical material contained in these tables as the figures refer only to minor points and fail to consider the most important point, *i. e.* the scientific activity. Productive and creative scientific work should form the basis of work at centres of academical education and provide the means of instruction, while didactic methods may be employed in all secondary and primary educational institutions.

For modern research work a considerable equipment is required. Libraries, laboratories and museums are no longer sufficient, but fields, gardens, accommodation for live stock, etc. are necessary in order to investigate the many questions which agricultural practice alone can never solve. In this respect the Berlin College, so richly endowed in other directions, is inferior to all the other academical centres of Germany with the exception of Kiel (see *table II* last column), and only now, after an existence of 32 years, is this lack of experimental equipment about to be remedied.

Table IV gives a summary of the attendance and expenses of the three higher horticultural institutions of Prussia. The lack of suitable experimental area at the Dahlem institution is striking, being probably due to the difficulty of obtaining suitable lands in the neighbourhood of Berlin.

Table V is a summary of the attendance and expenses of the secondary agricultural educational institutions: of the agricultural seminaries for the year 1911 (the second seminary being only founded in 1910) and of the agricultural schools for 1910. This table shows that at present the State contributes somewhat more than the sums of the independent incomes of these institutions and that, besides the State, the provincial and local authorities contribute to their maintenance.

The secondary agricultural educational institutions are everywhere provided with experimental fields but unfortunately, in a number of cases, the area is very insufficient. Greater facilities for object lessons would be very desirable.

Table VI is an summary of the attendance and expenses of farm and winter courses in Prussia in 1910. These show very different development in the various provinces. The best in this respect are the Rhine province, Hanover and Westphalia, then follow East Prussia, Schleswig-Holstein, Saxony, Brandenburg, Silesia and Posen; last of all come the district of Cassel, West Prussia and Pomerania, Wiesbaden and Hohenzollern being left out of consideration. The number of winter courses exceeds considerably that of the farm schools (212 against 17) and it would seem that the former are a form of agricultural education especially suitable for many localities.

The largest part of the expense of keeping up these schools is defrayed by the State, the next contribution in point of importance being provided

by their own income (school fees etc.), and smaller amounts by grants from the provincial and local unions, from local authorities and, lastly, from chambers of agriculture and agricultural associations, though the latter in a great majority of cases, were the original founders of the schools.

Table VII gives data referring to the specialised primary schools in Prussia, among which the farrier's schools are by far the most numerous, while financially the dairy schools are the most important. Next to these come the gardening schools. Further details can be seen in the tables. The directors of the winter courses and, to a great extent also, those of the specialized lower schools act as travelling lecturers in their spare time for their own districts, and do a great deal of good by gaining the confidence of the inhabitants and thus increasing the attendance at their schools. There are besides a number of official travelling lecturers not attached to any school.

Table VIII gives data concerning the unattached travelling lecturers and instructors in Prussia in 1910; their numbers, their districts and their salaries, as well the sources of the same. In point of importance the State grants come first, followed by those of the chambers of agriculture and of the agricultural associations; the latter organisations in most cases also decide upon the work that is to be done. Provincial or local unions limit their grants to travelling lecturers for fruit growing, wine making and animal husbandry.

Table IX is a summary of the state, expenses and distribution of schools of domestic economy in Prussia in 1910 for girls who have already received the ordinary compulsory primary education. In this group of schools upwards of 77 per cent. of their expenses are defrayed by their own income, 9 per cent. by district federations and local authorities, 6.4 per cent. by State aid and the rest by chambers of agriculture, associations, provincial federations, etc. Silesia is at the head of the list with 12 of these permanent institutions followed by the Rhine province with 9, Westphalia with 8, and the other provinces. The greater number are travelling schools, especially in the Rhine province, Hanover and Silesia. Next in order come the continuation courses in domestic economy, which are specially prevalent in East Prussia. It is greatly to be desired that this form of education, which has given such excellent results and is in such a flourishing condition, should continue to develop.

Table X shows the development of agricultural courses and continuation classes in the years 1910-11 and affords satisfactory proof of the interest taken by farmers in this form of education. The contribution from the State and other sources for the courses dealing with general subjects is small in comparison to their own income, but on the other hand this order of things is reversed in the case of the special courses which are much more numerous. The former are mainly attended by farmers from the districts in which large farms prevail, the latter by small farmers.

Table XI sets out the total expenditure for all the above mentioned educational institutions dealing with agriculture and domestic economy in Prussia. It shows that, of the total cost 36.9 per cent. is defrayed by the

independent income of the institutions, 39.9 per cent. by the State, 8.8 per cent. by the provincial federations, 8 per cent. by local authorities 5.2 per cent. by the Chambers of Agriculture and agricultural associations and 1.2 per cent. by other sources.

The State contribution of 3 871 385 marks (£189 698) was distributed as follows:

1) 1 455 472 marks (£71 318) to the academical and research institutions, and 1 435 marks (£70) to the general agricultural courses, making altogether 1 456 907 marks (£71 388) or 37.6 per cent. The part expended on education chiefly benefits the class of large landowners while the amount spent on research work and furtherance of agricultural science benefits every class of Prussian farmers.

2) 1 996 368 marks (£97 822) or 51.6 per cent. to the secondary and lower educational institutions, including 52 545 marks (£2 575) for special courses. Medium sized and small landowners and farmers are chiefly benefited by this contribution.

3) 329 963 marks (£16 169) or 8.5 per cent. to the higher horticultural schools.

4) 88 147 marks (£4 317) or 2.3 per cent. to education in domestic science.

Notwithstanding the fact that the greater part of the State contribution benefits the medium-sized and small farms, this outlay is very moderate for a State like Prussia and justifies the desire not only for increased grants but also for general progress in the whole system of agricultural education (1). Teaching by means of object lessons must be practised in every degree of agricultural education, from the lowest (which has not yet been universally adopted in Prussia) up to the highest, and to a much greater extent than has been customary until now, for such lessons produce a much more lasting effect than mere words.

The great progress that agriculture has achieved in Germany during the last quarter of a century is the result of the union of practice with science, and proves that money spent on research and on education in every class brings in a high rate of interest and is compensated by the increase of returns, of land taxes and of the revenue from the State railways. The expenditure of money on education is not an outlay but an investment which is eventually returned to the State with an abundant surplus, as though it were placed in some profitable business undertaking. It is therefore not only justifiable but, from the point of view of modern economics, actually necessary, until the highest possible rate of production be reached in all classes of farms and in all parts of the country. Failing to do so signifies an incomplete utilization of existing possibilities of production and keeping down the national wealth.

(1) Cfr. "*Testiagung des Kgl. Preuss. Landes-Och. Kollegium, 1913*" p. 80 et seq.

TABLE I. — *Institutions for agricultural education in Germany, taken from*

	Academic Institutions for agricultural education and research						Secondary schools			
	Universities	High Schools	Academies	Technical Colleges	Research Institutes	Veterinary Schools	Seminaries	Schools	Horticultural High Schools	Estate Management School
Prussia	5	I	I	—	I	2	2	18	3	I
Bavaria	—	—	I	I	—	I	—	3	—	—
Saxony	I	—	—	—	—	I	—	9	—	—
Wurtemberg	—	I	—	—	—	—	—	—	—	—
Baden	—	—	—	—	—	I	—	—	—	—
Hesse	I	—	—	—	—	—	—	I	—	—
Mecklenburgo	(2) I	—	—	—	—	—	—	—	—	—
Saxe-Weimar	I	—	—	—	—	—	—	—	—	—
Oldenburg	—	—	—	—	—	—	—	I	—	—
Brunswick	—	—	—	—	—	—	—	I	—	—
Thuringia, Anhalt, Waldeck	—	—	—	—	—	—	—	I	—	—
Free States	—	—	—	—	—	—	—	—	—	—
Alsace-Lorraine	—	—	—	—	—	—	—	I	—	—
Germany, total	9	2	2	I	I	5	2	35	3	I

(1) Only just started and still somewhat imperfectly organised.

TABLE II. — *Attendance and examination*

	Date of foundation	Total no. of students up to end of 1911-12	Nationality of students		
			Prussians	Other Germans	Foreigners
1. Halle University	1863	22 871	13 217	4 133	5 521
2. Goettingen »	1872	3 005	1 999	434	572
3. Kiel »	1873	186	152	16	18
4. Königsberg »	1876	2 059	1 659	62	338
5. Breslau »	1881	3 167	2 535	91	541
Total		31 288	19 562	4 736	6 990
Agr. Academy Bonn-Poppelsdorf	1847	6 889	5 411	860	618
Agr. High School, Berlin	1881	31 148	24 266	3 411	3 471
“Kaiser Wilhelm” Institute, Bromberg.	1906	27	27	—	—
Total		38 064	29 704	4 271	4 089
Total no. of students in all Academic Institutions.		69 352	49 266	9 007	11 079

TABLE III. — *Expenses of Academic Institutions*

	Salaries etc.	Running expenses	Up-keep of buildings and garden
	marks	marks	marks
Halle University	68 688	201 040	8 503
Göttingen »	63 762	61 063	5 590
Kiel »	800	1 055	—
Königsberg »	61 235	111 747	9 505
Breslau »	74 096	75 075	1 462
Total . . .	268 581	449 980	25 060
Agr. Academy, Bonn-Poppelsdorf	183 770	198 955	20 946
Agr. High School, Berlin (1).	337 419	211 583	22 346
“Kaiser Wilhelm” Institute, Bromberg . . .	74 730	159 128	6 797
Total . . .	595 919	569 666	50 089
Total for all Academic Institutions . . .	864 500	1 019 646	75 149

(1) Embraces the study of all agricultural industries (distillery, brewery, etc.).

(2) A property at Wunde also serves as an experimental farm.

(3) Some fields at Dahlem belonging to the Brandenburg Chamber of Agriculture are used

TABLE IV. — *Attendance and expenses*

Name and date of foundation	Total no. of students		Total expenses in 1910
	1910	Since the foundation	
			marks
Dahlem (1823)	110	1 088	152 515
Proskau (1868)	86	1 239	101 769
Geisenheim a. Rh. (1872).	81	1 538	227 200
special research students.	42	528	Sa 481 484
short course students . .	29	8 479	

and Agricultural Research Stations in 1910.

Travelling expenses	Other expenses	Government grant	Independent income	Total income	Area of experimental fields and garden
marks	marks	marks	marks	marks	ha.
500	1 500	195 201	85 030	280 231	116.83
628	92	100 773	30 363	131 136	(2) 11.20
—	1 680	3 535	—	3 535	—
1 200	—	139 947	43 740	183 687	137.76
600	—	123 716	27 517	151 233	32.58
2 928	3 272	563 172	186 650	749 822	298.37
9 624	18 404	193 792	237 907	431 699	147.70
6 008	33 984	452 851	158 489	611 340	(3) —
10 835	20 460	245 567	26 293	271 950	85.00
26 467	72 848	892 300	422 689	1 314 989	232.70
29 395	76 120	1 455 472	609 339	2 064 811	531.07

as experimental fields.

of Horticultural High Schools.

Receipts			No. of students having taken the diploma up to end of 1911	Area of experimental ground
Independent income	Government grant	Other grants		
marks	marks	marks		ha.
34 995	113 330	4 190	106	—
15 300	86 469	—	44	54.78
97 036	130 164	—	12	33.03
147 331	329 963	4 190	162	87.81

TABLE V. — *Attendance and expenses*

	No. of pupils in 1911		No. of pupils who have obtained the diploma up to 1911-12	Teaching staff		Independent income —
	Total	Farmers' sons		Masters and direc- tors	assis- tants	
<i>Agricultural Seminaries (1911).</i>						marks
Königsberg	15	—	40	2	6	4 204
Schweidnitz	27	—	27	1	8	9 450
Total . . .	42	—	67	3	14	13 654
<i>Agricultural Schools (1910).</i>						
Heiligensbeil	176	67	403	8	2	20 221
Marggrabowo	127	41	286	11	3	22 904
Marientburg	256	106	810	11	4	35 752
Dahme	327	123	826	13	1	43 645
Schivelbein	213	69	687	10	—	26 733
Eldena	182	77	504	9	3	22 560
Samter	199	48	586	8	1	25 841
Bojanowo	159	55	51	8	1	18 982
Brieg	250	98	709	8	6	28 835
Liegnitz	298	117	792	9	6	36 532
Salzwedel	257	69	33	10	—	29 629
Flensburg (1)	76	39	310	6	5	135 237
Hildesheim	237	148	877	13	1	40 051
Lüdinghausen	204	75	863	12	1	36 926
Herford (2)	301	56	481	15	3	36 105
Weilburg	99	28	396	8	2	18 362
Cleve	312	98	846	12	3	42 672
Bitburg	195	95	1 337	7	6	23 525
Total . . .	3 868	1 389	10 797	178	48	644 512
Total for seminaries . . .	—	—	—	—	—	13 654
Total . . .						658 166

(1) Excluding preparatory classes. — (2) Including pupils of technical schools.

of secondary agricultural schools.

Grants from:				Total receipts	Total expenses	Area of experi- mental ground
the State	provincial and local unions	local authorities	chambers of agriculture and agricultural societies			
marks	marks	marks	marks	marks	marks	ha.
—	500	—	500	5 204	5 204	—
10 000	—	—	2 750	22 200	22 700	—
10 000	500	—	3 250	27 404	27 404	—
40 950	—	1 090	—	62 171	82 062	0.3037
42 250	—	11 698	—	76 852	76 852	0.1763
54 020	4 500	4 450	—	98 722	102 012	0.04
39 350	—	160	—	83 155	85 120	0.3570
36 350	4 500	13 395	—	80 978	80 344	0.13
33 960	4 000	3 900	—	64 410	81 457	0.25
34 370	—	971	—	61 182	65 072	0.1225
36 300	1 000	5 175	500	61 957	61 980	0.5
30 055	2 400	—	1 590	62 790	62 790	2.0
30 075	7 500	—	3 750	77 857	77 857	0.5
21 000	—	20 857	—	71 486	71 486	0.5
33 115	—	70 155	2 000	240 507	240 507	0.16
45 950	—	1 304	—	87 305	91 805	0.64
34 200	9 500	5 212	200	85 038	85 267	2.6
37 750	8 000	27 265	—	109 120	106 120	1.0
43 550	2 900	8 259	—	73 071	73 071	0.7686
30 600	4 500	4 375	—	82 147	82 147	1.5
31 300	4 500	2 400	—	61 725	64 133	1.5
655 135	53 300	179 576	7 950	1 540 473	1 590 082	13.0481
10 000	500	—	3 250	27 404	27 404	—
665 135	53 800	179 576	11 200	1 567 877	1 617 486	13.0481

TABLE VI. — *Attendance and expenses of elementary*

	Total no. of schools and courses 1911-12	No. of pupils 1911-12	Average per school	Total no. of pupils in school up to March 1912	No. who took full course	pro- vincial and local unions
East Prussia	19	690	36	8 437	3 808	—
West Prussia.	9	377	42	3 595	1 866	—
Brandenburg	13 (4)	524	40	5 787	2 757	—
Pomerania	7 (1)	325	46	3 448	1 263	—
Posen	13	427	33	3 629	1 482	—
Silesia	13 (1)	798	61	15 228	6 535	—
Saxony	13 (1)	779	60	16 574	9 119	—
Schleswig-Holstein	14 (2)	940	67	11 320	5 450	—
Hanover	42 (5)	2 268	54	37 288	13 788	(1)
Westphalia	23 (1)	1 475	64	21 755	8 285	—
District of Cassel	10	404	40	5 035	1 966	—
District of Wiesbaden	4	130	32	1 700	543	—
Rhine province	47 (1)	1 336	28	20 541	7 602	1
Hohenzollern	2 (1)	55	27	747	644	2 (1)
Total . . .	229 (17)	10 528	46	155 084	65 108	3 (2)

(1) Figures in brackets refer to schools.

TABLE VII. — *Attendance and expenses*

	No. of schools	Total no. of pupils		Total expenses in 1910 marks
		1910	up to end of 1911-12	
Dairy Schools	15	393	7 191	424 267
Gardening Schools	14	318	3 788	357 783
Farmery Schools	70	1 105	21 143	132 163
Grass Management Schools	5	581	4 157	108 596
Poultry Farms	7	188	1 160	86 985
Beekeeping Schools	3	91	1 319	6 589
Total . . .	114	2 676	38 758	1 116 383

agricultural institutions. (Schools and winter courses).

Schools founded by:				Expenses					
local authorities		chamber of agr. and agr. societies	private enterprise	Total	paid by:				
"Kreise"	"Gemeinden"				independent income	the State	provincial and local unions	local authorities	chambers of agr. and agr. societies
				marks	marks	marks	marks	marks	marks
—	—	19	—	155 312	20 739	84 700	28 415	15 046	7 407
—	—	9	—	96 382	10 677	67 098	9 236	11 260	500
—	1	12 (4)	—	178 158	50 677	52 750	48 017	21 809	16 777
—	—	7 (1)	—	107 183	23 922	36 281	18 600	7 800	20 580
—	—	7	6	121 095	15 274	77 298	17 195	10 450	2 297
—	—	12	(1)	146 363	34 967	46 360	38 710	13 850	17 276
—	—	12	(1)	169 358	81 585	12 754	64 158	11 731	600
12	(2)	—	—	159 063	55 933	34 218	27 000	39 832	2 080
35 (1)	3 (2)	2 (1)	1	372 745	131 786	53 042	75 518	99 304	9 080
16	2	—	5 (1)	229 204	57 470	35 590	37 538	28 565	3 863
—	—	10	—	86 866	12 456	30 550	19 500	23 000	1 360
—	1	3	—	17 938	2 120	9 000	3 600	4 543	1 500
—	2 (1)	44	—	288 815	34 798	70 720	114 200	60 950	8 147
—	—	—	—	10 148	388	—	9 750	—	60
63 (1)	9 (5)	137 (6)	12 (3)	2 138 730	532 832	610 361	511 437	402 140	91 527

at special elementary schools.

Expenses defrayed by:					
independent income	grants from:				
	the State	the province	local authorities	chambers of agr. and agr. societies	founders etc.
marks	marks	marks	marks	marks	marks
255 303	101 383	35 983	100	26 674	6 723
132 922	41 378	135 185	7 488	23 990	16 600
54 708	22 376	7 690	38 856	8 111	—
40 943	25 554	29 855	7 783	1 200	3 261
44 676	33 672	—	—	8 637	—
1 958	1 650	1 500	—	350	1 369
530 530	226 013	210 213	54 227	68 962	27 953

TABLE VIII. — *Number and expenses*

Subjects	No. of lecturers	Salaries and travelling expenses
		marks
a) General.	26	81 915
b) Practical agriculture.	1	1 641
c) Seed selection.	9	20 508
d) Peat bog cultivation	1	7 465
e) Flax culture.	1	2 724
f) Management of pastures	1	4 536
g) Fruit growing and market gardening	42	169 454
h) Viticulture and market gardening.	2	9 790
i) Viticulture	4	17 381
k) Live stock	42	235 578
l) Pig breeding	4	21 502
m) Dairying	12	62 550
n) Horse breeding	6	43 367
o) Farriery	4	9 835
p) Poultry keeping.	10	44 281
q) Pisciculture	1	7 062
r) Cooperative live stock	3	11 828
s) Cooperative societies.	4	31 628
t) Book keeping	3	7 668
u) National economy	3	1 598
Total . . .	179	792 311

of official travelling lecturers.

Expenses defrayed by				
the State	provincial and local unions	local authorities	chambers of agriculture and agricultural societies	other sources
marks	marks	marks	marks	marks
49 322	—	—	32 593	—
1 359	—	—	282	—
10 073	—	—	10 435	—
7 068	—	—	397	—
2 618	—	—	106	—
3 000	—	—	1 536	—
95 480	15 950	6 499	46 841	4 684
2 650	1 200	—	5 940	—
9 625	7 756	—	—	—
141 231	16 150	—	77 597	600
10 000	—	—	11 502	—
23 694	—	—	24 620	14 236
24 000	—	96	19 271	—
6 660	—	—	3 175	—
29 401	—	—	14 880	—
750	750	—	5 562	—
10 341	—	—	1 487	—
11 142	—	—	13 514	6 972
3 900	—	—	3 768	—
—	—	—	1 598	—
442 314	41 806	6 595	275 104	26 492

TABLEAU IX. — *Schools of domestic economy, exp.*

Province	Kind of school					Total expenses — marks	independent incomes marks
	Total no. of schools	Schools for general domestic science	Schools for agr. domestic science	Travelling schools	Continua- tion courses		
East Prussia	64				63	65 588	
West Prussia	2	1				71 666	
Brandenburg . .	2		1			20 476	
Pomerania . .			1	7		23 284	
Posen.	7	1	3	3		82 072	
Silesia.	21		12	9		183 764	
Saxony . .	12	1	5	4		188 947	
Schleswig-Holstein	3		3			55 685	
Hanover	14		3	11		131 216	
Westphalia, . . .	15			6		146 913	
District of Cassel	8	1		7		70 510	
» Wiesbaden	11		3	8		61 792	
Rhine province	51		9	33		261 761	
Hohenzollern	3					13 529	
Prussia . . .	221		52	90	66	1 377 203	

economy, expenses and receipts in 1910.

independent incomes	Expenses defrayed by						
	grants from						
	the State	provinces	local authorities		women's societies	chambers of agr. and agr. societies	other sources
			" Kreise "	" Gemein- den "			
marks	marks	marks	marks	marks	marks	marks	marks
44 001	14 050	5 000	1 787	500	—	250	—
60 151	4 830	—	—	—	2 685	—	—
11 110	900	2 500	800	700	—	4 434	32
16 755	750	150	2 319	400	—	2 705	205
60 144	18 386	2 000	300	300	327	500	115
154 871	8 876	—	3 417	610	660	8 209	3 121
179 000	4 000	—	2 500	—	1 638	1 548	261
42 053	5 800	—	200	—	200	7 239	193
109 045	4 800	2 400	5 054	750	1 190	2 053	5 914
104 146	250	4 250	25 014	3 420	612	1 675	7 546
59 540	5 455	—	3 083	805	1 503	—	124
39 935	2 500	300	6 821	1 864	200	1 800	8 372
172 878	11 900	5 700	53 566	6 934	757	2 400	7 626
8 934	1 650	430	430	—	—	—	2 085
1 066 563	88 147	22 730	105 291	16 283	9 772	32 813	35 604
77.4%	6.4%	1.7%	8.8%		0.7%	2.4%	2.6%

TABLE X. — *Agricultural courses*

Courses	Year	No. of courses organised	Attendance	Elementary schoolmasters attending courses
1. General agricultural courses for practical farmers	1909	33	4 436	—
	1910	37	5 316	—
	1911	30	3 912	—
2. Special courses	1909	1 128	23 925	838
	1910	1 153	25 708	954
	1911	1 324	32 029	824
Total for each year . . .	1909	1 161	28 361	838
	1910	1 190	31 024	954
	1911	1 354	35 941	824
Total for three years. . .	—	3 705	95 326	2 616

TABLE XI. — *Total cost of all*

	No. of institutions	Independent income	
			the State
		marks	marks
Academic education	8	609 339	1 455 472
Horticultural high schools	3	147 431	329 963
Secondary schools	20	658 166	665 135
Farm schools and winter courses . .	229	532 832	610 361
Primary education	114	530 330	226 013
Travelling lecturers	179	—	442 314
Schools of domestic economy . . .	212	1 066 563	88 147
Special agricultural courses	1 190	33 462	53 980
Total . . .	—	3 578 223	3 871 385
Per cent . . .	—	36.9 %	39.9 %

and continuation classes 1909-1911.

Total expenses	Expenses defrayed by:					
	fees	grant from:				
		the State	provincial and local unions	local authorities	chambers of agr. and agr. societies	other associa- tions
marks	marks	marks	marks	marks	marks	marks
16 107	13 294	559	—	—	2 084	170
18 692	11 051	1 435	750	—	3 656	1 800
15 692	11 606	772	—	—	3 094	220
131 050	22 538	54 616	9 787	10 508	17 314	16 287
123 071	22 411	52 545	8 654	7 694	17 412	14 355
119 702	20 130	51 068	9 824	9 169	13 408	16 103
147 157	35 832	55 175	9 787	10 508	19 398	16 457
141 763	33 462	53 980	9 404	7 694	21 068	16 155
135 394	31 736	51 840	9 824	9 169	16 502	16 323
424 314	101 030	160 995	29 015	27 371	56 968	48 935

agricultural education in 1910.

Grants from:				Total receipts
provincial unions	local unions	chambers of agr. and agr. societies	others	
marks	marks	marks	marks	marks
—	—	—	—	2 064 811
—	—	—	4 190	481 484
53 800	179 576	11 200	—	1 567 877
511 437	402 140	91 527	—	2 148 297
210 213	54 227	68 962	27 953	1 117 898
41 806	6 595	275 104	26 492	792 311
22 730	121 574	32 813	45 376	1 377 203
9 404	7 694	21 068	16 155	141 763
849 390	771 806	500 674	120 166	9,691 644
8.8 %	8.0 %	5.2 %	1.2 %	—

The Cattle Industry in Italy at the Present Day

by

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THE 1908 CENSUS AND RELATIVE DENSITY OF CATTLE IN THE VARIOUS REGIONS OF ITALY.

In all live stock censuses taken previous to March 19, 1908, the data was supplied by the owners of the animals themselves who filled in special forms; but in the 1908 census, the data was collected by census officials, this system having been rendered possible by the improvements in the technical and administrative services of the local and provincial governments. Its results are therefore much more reliable than preceding ones. They show that in the whole country there existed altogether 6 192 861 head of cattle distributed as follows:

1 390 550 calves under 1 year of age	22.4 per cent
126 583 bulls over 1 year of age	2.1 "
3 403 377 heifers and cows over 1 year of age	54.9 "
1 276 346 oxen and steers over 1 year of age	20.5 "

In comparison with the numbers of the preceding census (1881) the increase returned was 1 426 609 head, that is, in 27 years the number of cattle increased by one third of the number existing in February 1881. The variation in each class and in the distribution of the total herd being as follows: (Tables I and II).

TABLE I.

Year	Calves	Bulls	Cows and heifers	Oxen and steers	Total
1881.	957 307	45 092	2 366 536	1 403 207	4 772 162
1908.	1 390 553	126 583	3 403 377	1 276 346	6 192 861
Difference. . .	+ 433 246	+ 81 491	+ 1 036 841	- 126 861	+ 1 426 609

Arranging the 16 regions of Italy according to the number of cattle per unit area, they appear in the following order:

1. Emilia. — 2. Lombardy. — 3. Venetia. — 4. Piedmont. — 5. Marches — 6. Liguria. — 7. Tuscany — 8. Sardinia. — 9. Campania. — 10. Umbria. — 11. Latium. — 12. Calabria. — 13. Abruzzi and Molise. — 14. Sicily. — 15. Basilicata. — 16. Apulia.

With the exception of Liguria, the provinces of Northern Italy show the highest figures for density of cattle. Next come Central Italy together with Sardinia and Campania, and last of all the Southern Provinces and Sicily.

TABLE II. — *Distribution of cattle.*

	No. existing on March 19, 1908			Increase over the census of 1881			
	per sq. mile		per 100 inhabitants (census 1-1-1908)	Absolute increase	per sq. mile		Per 100 animals returned in 1881
	of the geographical area	of the crops and permanent pasture area			of the geographical area	of the crops and permanent pasture area	
Piedmont	84.66	133.33	27.9	118 947	10.43	16.31	14.06
Lombardy	116.76	171.91	23.9	254 006	21.77	40.13	29.13
Venetia	97.61	132.82	27.1	190 058	19.30	27.18	25.04
Liguria	47.16	124.53	8.4	12 544	6.14	15.79	14.63
Emilia	120.13	159.48	38.1	302 188	34.80	49.97	45.90
Marches	68.35	83.11	23.8	63 703	17.01	20.45	33.10
Umbria	35.21	50.49	19.1	33 239	8.83	12.69	33.62
Tuscany	42.46	70.42	14.8	46 317	5.41	9.06	14.95
Latium	28.22	39.09	10.1	37 227	7.97	11.13	39.48
Abruzzi and Molise .	22.52	30.55	9.9	43 482	6.78	9.06	43.07
Apulia	12.95	17.86	4.6	Diminished			
Campania	35.73	49.71	7.0	84 581	13.46	18.64	60.09
Basilicata	16.83	23.56	13.9	24 175	6.27	8.54	58.90
Calabria	24.85	39.87	10.2	59 335	10.17	16.31	69.00
Sicily	19.94	25.37	5.5	73 079	7.33	9.32	58.28
Sardinia	40.25	45.57	44.4	98 303	10.54	11.91	35.18
The whole Kingdom.	55.92	61.52	18.3	1 426 699	12.87	13.98	28.90

IMPROVEMENT IN THE QUALITY OF THE CATTLE AND BRIEF SURVEY OF THE PRINCIPAL BREEDS AND VARIETIES.

The Italian breeds and varieties have undergone variations of late in their anatomical and physiological characters owing to improved environmental conditions, especially of feeding, and to progress in the methods of breeding and rearing. Some breeds have improved considerably with regard to their live weight, early maturity and milk yield, especially those belonging to regions where agriculture and animal husbandry are best developed. It is only during the last few years that series of observations on the morphological and physiological characters of the live stock have been made here and there, and there is as yet no complete and systematic description of the Italian breeds and varieties. Thus direct and precise chronological comparisons cannot be made. But the progress already achieved can be gauged by a number of facts intimately connected with the country's production and consequently with the productiveness of the animals. Owing to her great variety of climate, soil and agricultural conditions,

Italy possesses many different breeds and varieties of cattle; almost every region has its own, and in some of them the varieties are numerous, as in the various belts of mountains which form the Alps and the Apennines. But not all of them have the same importance nor have they all undergone the same progressive evolution with the renewed agricultural and economic activity of the country. Among the number, some deserve to be especially mentioned as they possess qualities in virtue of which they may well compete with foreign breeds.

A. *Piedmont*. — Among the several Piedmontese breeds the prevailing and characteristic breed is the cattle of the *Piedmontese Plain* which varies somewhat from one part to another according to local conditions. It is divided into *Improved Plain breed* and *Common Plain breed*. The best specimens of the former, called also the *Carmagnola* breed, are found in the districts of Carmagnola, Savigliano, Bra, Racconigi and Chieri. The animals are high standing, light dun, or often white, with black points. They are good workers and beef producers and fair milkers. They are not coarse and, being rather early maturing, they fatten easily on suitable food and yield highly esteemed flesh. At the age of 18 to 20 months they weigh upwards of 1320 lbs. At the age of four years they weigh upwards of 2200 lbs and fat oxen, though not highly finished reach from 2420 to 2640 lbs and more. The second division of the breed which is found in the valleys and on the hills south of the Po, along the course of the Stura, the Tanaro and the Scrivia, and in several parts of the province of Cuneo, differs from the preceding breed by its greater hardiness, its smaller stature and by its red coat. It is a better working animal but a poor milker and only fairly suitable for fattening. This latter quality is however more developed in certain improved strains such as the cattle of the Langhe hills.

In the mountainous parts of Piedmont, the cattle is very varied and consists of numerous ill-defined breeds and varieties:

The cattle of the Stura valley belongs to the *Demonte* breed, so called from its principal centre of production. It resembles the *Piedmontese Plain* breed and, according to some observers, also the *Alpine* type. It is a good working animal and a fair milker.

The *Valdostana* breed inhabits the valley of Aosta and the numerous neighbouring valleys. It is small in stature, rarely over 4 ft. high, while some cows just reach 3 ft. 3 in. Its coat varies very much, being red, or dark chestnut, or spotted red, or spotted black. Breeders prefer dark red, chestnut and spotted red. The great variety in the colours is attributed to the large number of out crosses constantly occurring. It is chiefly suitable for the production of milk, from which butter and the cheese called "fontina" are made. *Valdostan* cows yield on average about 1.32 gallons of milk per day, or 330 gallons in 8 months, some attaining 440 and even 528 gallons. The cattle are kept in the valleys during the winter and from June to September on the Alps up to a height of 8000 feet.

In the valleys of the district of Finero the prevailing breed is called *Tarantaise* or *Tarina* after its place of origin (Tarantasia in the upper Isère valley) or, more commonly, *Savoyard*. SANSON includes it among the

varieties of the *Alpine* breed. The average weight of the bulls and oxen is between 1320 and 1540 lbs and of the cows 880 to 1100 lbs. The stature of the adult animals is about 5 ft. 4 in. The coat is dun, darker in the males, with black points. They are good strong working animals being at the same time fair producers of meat, while the cows are good milkers and yield 440 to 550 gallons of milk per annum. The lactation period lasts about seven months, the quantity of milk being relatively uniform and diminishing but slightly.

On the mountains in the neighbourhood of Biella there is a breed of small spotted cattle not without merit for its build and yield of milk. It is known as the *Oropa* breed, and the area it occupies is rather limited.

Besides the local breeds of cattle, which are the prevailing ones in Piedmont, there are also foreign breeds such as the *Schweyz* cattle, especially in the irrigated parts of the provinces of Novara and Vercelli, where the characteristic farming of the lower Po valley begins. *Dutch* cattle are also met with here and there, but not so frequently, though there are some herds of a certain importance, such as for instance the herd belonging to COMM. VIGNOLA at Marozzo in the Mondovì district. These two breeds are kept pure, and also crossed, the crosses being much esteemed for their milking qualities.

B. Lombardy. — Both in Upper and Lower Lombardy, and more especially in the latter, cattle are kept chiefly for the production of milk, hence the great prevalence of the breeds and varieties which are heavy milkers.

In the rich plain that includes the Lomellina district, the neighbourhood of Pavia, the lower Milanese territory and the province of Cremona the brown *Schweyz* breed is the most prevalent.

For the most part these animals are imported directly from Switzerland or from the Italian pre-alpine districts for the immediate and exclusive production of milk. There is thus no local breed nor is breeding and rearing of young animals generally practised. Very nearly the same may be said of those other districts presenting similar agricultural conditions, such as the lower part of the provinces of Bergamo and Brescia and a good portion of the province of Mantua, as well as some belts of land on the right bank of the Po.

The Alpine region is stocked with cattle belonging to one type, but varying in appearance and characters from one locality to another according to local and climatic conditions. SANSON groups all local varieties under the comprehensive denomination of *Alpine* breed. Considering the favourable natural conditions of this region it ought to be capable of stocking the byres of Lombardy and other lowland regions, a branch of industry hitherto left to Switzerland. Of late years the general improvement in the animal husbandry of the country has also been spreading in this region, and already considerable progress is noticeable: some valleys of the provinces of Sondrio, Bergamo and Brescia are already in a position to supply dairy cattle, and several provinces of the kingdom have recourse to them for restocking their cattle sheds and byres. These results are largely due to the spread of associations for the promotion of agriculture and animal husbandry, to the

institution of herd-books, to cooperative dairies, to associations for the alpine grazing of young animals etc.

Working oxen are also an important item amongst cattle in Lombardy, and are represented by several breeds. In the territory bordering on Piedmont the cattle of the *Piedmontese Plain* prevail, partly imported directly and partly bred in the locality itself. In the provinces of Brescia, Cremona, Bergamo the so-called *Tyrollese* breed is largely represented, derived either directly from the Tyrolean cattle or from its more local representatives, the best types of which are the *Meran* and the *Ullen Valley* breeds; these animals are highly esteemed both as working and beef animals, as they fatten well and give a good carcase weight. A certain contingent is also supplied by cattle of *Podolian* breeds and by several crosses.

C. Venetia.—The lack of definite varieties which characterizes the cattle of almost all the Alpine regions is more marked in the large mountainous district which constitutes the greater portion of Venetia than anywhere else. In this mixture of types however a common relationship to the *Alpine* type can be traced. They are small animals destined exclusively to the production of milk for which they are fairly suitable. A certain amount of selection is observed in their breeding and good results have been obtained by crossing the cows with *Schweyz* and *Tyrollese* bulls. Breeding and rearing are in the hands of small breeders who up to recent years were very poor. Hence the deplorable condition into which live stock raising had fallen in that part of the country. But the establishment of cooperative dairies, which actually originated in this part of the country has marked the beginning of a new era. The first cooperative dairy began operations at Forno di Canale, near Agordo, on January 8, 1872. Since then cooperation has rapidly increased and perfected itself, and is proving most beneficial to the improvement of the cattle of the district.

In the rest Venetia working cattle prevail, and these are also used for the production of meat with more or less success according to the breed and general management. In the provinces of Rovigo and Padua the *Podolian* breed, commonly known as *Apulian* or *Paduan* is the most frequently met with. It is also found to a lesser extent in other provinces of the same region. Its characters are common to the cattle of Ferrara and Bologna districts and of Southern Italy. It is chiefly a working animal, being hardy and resistant, a very poor milker and fattens only to a limited extent. To the north of the province of Padua the most diffused breed is the *Tyrollese*, in which hardiness is blended with a certain degree of fineness so that it supplies animals suitable for draught purposes and at the same time producers of meat and milk. In the same province a certain number of *Simmentals* have lately been introduced. There are also a few *Schweyz* and *Rendena Valley* cattle.

But the greatest progress in animal husbandry has been made of late in Lower Friuli, where the local cattle has been radically transformed by crossing with *Simmentals*, so much so that the old dun *Friuli* breed as well as the *Jurassic* type have been almost completely replaced by the new cattle, known in the market as *Simmental-Friuli*. The names of two of

the principal men connected with this improvement are Dr. GABRIELE LUIGI PRECILE (senator) and Dr. G. B. ROMANO (vet. surgeon). The same transformation has been carried out in Friuli as in the Grand-duchy of Baden and it is an unique example in the development of animal husbandry in Italy of what can be achieved with suitable means and perseverance. The first attempts were made in 1870; the local government of the Province of Udine began by importing bulls from Meran and from Switzerland which were immediately sold by auction; the third year only *Friburg* bulls and heifers were imported. Sufficient funds having been voted in the budget, the yearly imports of breeding cattle has been continued, but after the first few years these have consisted entirely of *Simmentals*.

D. Liguria. — The cattle of Liguria is unimportant and is composed of types belonging to the neighbouring provinces. Besides a certain number of milch cows of various origins, but chiefly of the *Alpine* type, for the supply of milk to the centres of population, there are also *Piedmontese*, *Podolian* and *Pontremolese* cattle and various crosses.

E. Emilia. — Emilia is one of the regions in which great progress has been made in animal husbandry during the last thirty years. Its cattle is chiefly composed of native breeds, some of which are deservedly held in high esteem both at home and abroad. In some provinces there are also more or less numerous herds of foreign breeds especially in the milk producing belts. The *Schweyz* breed is widely spread especially in the irrigated parts of the provinces of Piacenza, Parma, Reggio, Modena and, to a lesser extent, in the other provinces. It is bred pure and also crossed with the local breeds. In these provinces *Dutch* cattle is also represented, but to a much more limited extent. The province of Piacenza has the greatest number of both breeds. In the province of Reggio, *Simmentals*, which have much affinity with the local breed, are becoming increasingly popular; for several years they have been imported in considerable numbers both for pure herds and for crossing, with good results in both cases. *Durhams* and *Charolais* were imported several times into the provinces of Piacenza, Modena and Ferrara, but they were not successful and had no influence on the general trend of production. In this region the native local breeds are the most important, the chief of which are as follows:

a) The *Reggio-Parma* breed (or the *Dun-red Reggio* as it is called by the local breeders) is the prevailing breed in the plains and on the slopes of the Appennines in the two provinces of Reggio and Parma and spreads also into the province of Piacenza where it was once in great demand. It is considered a pure breed because its coat colour, which is its principal characteristic, is fairly constant. According to prevailing opinion it owes its origin to SANSON's three breeds: *Jura*, *Alpine* and *Iberian*; in fact it presents the characters of the three types in various combinations with a prevalence sometimes of one and sometimes of another, and lacks that uniformity which is the chief characteristic of pure breeds. The coat is sorrel and was formerly reddish, but with the improvement of the breed it has gradually grown paler. The principal external characters are a

very uniformly coloured coat which is extended to the brush of the tail, a depigmentation of the horns and hoofs and a flesh coloured muzzle. Brownish spots, streaks and shadings are considered signs of bastardy, and formerly depreciated the animals especially for breeding purposes. Now breeders are less strict upon this point and consider productivity more important. The stature, coat, shape, live weight and general performance of this breed of cattle are very variable. The Reggio strain is distinguished from that of Parma by a greater uniformity especially in the coat, due to the careful and persevering selection that these breeders have always practised and which some continue to practise with extreme care. A confirmation of this is afforded by the fact that the Parma breeders usually purchase their bulls from those of Reggio. This breed of cattle, which combines the qualities of working animals with those of meat and milk production, are specially noted for their milking qualities which form the basis of the flourishing local dairy industry.

The breed has been considerably improved during the last thirty years, especially with regard to increased milking capacity, the improvement being assisted by the great development of forage crops, notably lucerne, in that region. The striking increase in the number of dairies and the growth of the manufacture of the famous "grana" cheese of Reggio (known as Parmesan) cannot be solely attributed to the increased number of milch cows belonging to other breeds, as the numbers imported have not been relatively large. In this connection it should be noted that in the districts where cheese making is most developed, as in the plains of Reggio and Parma and in their continuation in the provinces of Piacenza and Modena, there is a very marked decrease in the number of oxen and steers and a considerable increase in that of cows and heifers, of bulls and of calves under one year of age. This has become possible owing to the smaller demand for working animals due to the larger acreage in forage crops. The cattle have also been improved with regard to meat production.

b) The so called *Bardigiana* or *Bardi* breed, perhaps more properly called *Valtarese* or *Taro Valley* breed, is a variety of the mountain breed which stocks the mountains of Piacenza and of Parma and which spreads also to the Pontremoli and Genoese districts. The principal centre of this breed is in the upper Taro valley from whence it spreads into Lunigiana and the Bardi Valley. The calves are sent to the latter districts immediately after weaning and kept there till four years old when they are bought by the farmers of the plains who use them for draught purposes. The breed is of small stature. The males stand 4 ft. 4 in. high, the females 4 ft. but they are compact and fairly well shaped. The fore quarters, as in the *Podolian* type, are more developed than the hind ones, the limbs are short with very hard hoofs which allow the unshod oxen to stand long journeys on the mountain roads. The coat is red in the main with darker patches and black points; owing to their hardness they are excellent workers. They are not exacting, will adapt themselves to any kind of conditions, and, having a powerful digestion, usually present a thriving appearance with a certain

disposition to fatten. On being transferred to the plains, they respond to the higher feeding, increase in size, fatten easily and yield excellent meat.

c) Another variety of mountain cattle, much resembling the above in its anatomical and physiological characters, is known under the name of the *Langhirano* breed. It differs from the *Taro Valley* breed only in having a greyish coat with darker patches, and like it resembles the *Podolian* type. It is found in the upper part of the valleys of the Enza, Parma and Baganza and is rather frequent on the Emilian Appennines. The oxen are robust and powerful draught animals and are much used for farm work both in the hills and plains.

d) The *Modenese* breed stocks the plain of the province of Modena and a small part of the neighbouring province of Reggio. It is also called *Carpigiana* because Carpi is its centre of production. Strictly speaking it is not a pure breed but is derived from both the *Jurassic* and *Alpine* types and exhibits even now a somewhat ill-defined mixture of both types. The prevailing colour is dun not infrequently milky white and often more or less gray. The Modenese breeders attach much importance to the pigmentation of certain parts of the body *i. e.* the tips of the horns, brush of the tail, eyelashes and hoofs should always be black, while the muzzle should present the so-called split or "grugn sciarpé" appearance, that is to say the whole muzzle is blackish with a red line down the centre. This breed of cattle produces both milk and meat and is also used for draught purposes. It is not such a good milker as the *Reggio Parma* breed, but some cows yield up to 3.3 gallons per day during the early part of the lactation. Of late years dairying has much increased in the plains of Modena and especially in that part bordering on the province of Reggio where conditions are somewhat resemble those of Reggio.

e) The cattle stocking the the rest of Emilia, that is the provinces of old Romagna, namely Bologna, Ferrara, Ravenna and Forlì, are for the most part derived from the *Podolian* breed, evidences of their common origin being very apparent in the various breeds. Three breeds are commonly recognised: the *Bo'ognese*, the *Ferrarese* and the *Romagnola* proper. The third is the most interesting on account of the great improvement it has undergone. Recently the other two also have been improved, especially the *Bolognese*, but to a lesser extent. The latter varies according as its habitat is in the plains or in the mountains. The plains cattle has a gray coat, sometimes light and almost white; it stands high and has a certain degree of fineness. The mountain cattle is of a darker gray with patches of a deeper colour still. They are smaller and more compact, very strong and hardy and possess very hard hoofs. Both are decidedly suitable as working animals, more especially the mountain cattle, while the plains cattle, on the other hand, produce fair meat. The breeders in the plain of Bologna, especially in the Imola district, are gradually adopting the methods which have been so successful in the adjoining province of Forlì.

The improved *Romagnola* breed ("gentile Romagnola") dates its improvement from about twenty years ago, and is now so changed that *Podolian* characteristics have almost disappeared. It is found

in the plains of the two provinces of Forlì and Ravenna and spreads over the borders of the adjoining province of Bologna. The cattle of the mountainous belt is of the same type, but differs from it by its greater hardiness and by being chiefly a working animal. The improved cattle are large, high standing animals; the calves, as in all the breeds descended from the *Podolian* type, have, up to the age of about three months, a reddish coat which then turns to a lightish gray, with a tendency to white; the bulls are darker gray and with age patches of deeper colour appear, whilst cows and oxen remain a more uniformly dirty white. Both sexes have black points. The horns are not much developed, lyre shaped and black tipped. The whole body is harmoniously proportioned with the exception that the fore quarters are more developed than the hind ones, this being one of the characteristics of the *Podolian* type. Muscles masses are rather abundant. This breed of cattle combine more especially the qualities of working animals and butcher's beasts. Without possessing their primitive hardiness they are nevertheless sufficiently strong and robust to satisfy the demands of farm work and at the same time they possess that early maturity and fineness which are essential requisites in butcher's animals. The yield of milk is very small, barely sufficient for nourishing their own calves. Early maturity and a marked suitability for fattening are characteristic of the new breed.

At the age of four years, or shortly after, the incisors are all permanent, usually earlier in bulls than in the cows or oxen. The live weight of the calves at birth varies from 88 to 110 lbs. When adult, cows weigh on an average 1320 lbs, oxen 1540 lbs and bulls and fat oxen 2200 lbs and over. In the lot exhibited by the Torlonia Estate of Torre S. Mauro, Romagna at the Milan Exhibition in 1906 there were young bulls which at the age of 10 or 11 months weighed from 880 to 990 lbs; four year-old bulls which weighed nearly 2400 lbs; one year-old heifers about 880 lbs, two year-old 1320 lbs and three year-old 1430 lbs; cows from 5 to 6 years of age 1540 to 1760 lbs; oxen between 2 and 2 ½ years of age weighed from 1170 to 1670 lbs and those between 5 and 6 years 2110 to 2220 lbs (1). All *Romagnola* cattle is not improved to the same extent. The greatest degree of progress has been achieved in the principal centres of production, *i. e.* in the neighbourhood of Cesena and Rimini. The fame acquired by the breed during recent years is principally due to the enterprising spirit and perseverance of LORRIPPO TOSI.

(To be continued)

(1) Ing. L. TOSI and Dr. G. SBROZZI. — *La razza bovina romagnola dell'azienda Torre S. Mauro (Fattoria Torlonia)*. — Padova 1906.

Present State of Cattle Breeding in Uruguay

by

TEODORO and JUAN ANGEL ALVAREZ

Historical. — Up to the end of the sixteenth century there were no domestic animals in Uruguay. The natives lived exclusively by hunting, fishing and utilising the natural products of the soil. The first Spanish colonies founded along the banks of the Uruguay had only a brief existence. In 1603 the Governor HERNANDARIA DE SAAVEDRA caused a hundred head of cattle to be imported from Argentine together with two droves of mares and placed them in a locality provided with good pastures and plenty of water, where, together with other animals subsequently imported, they were allowed full liberty and multiplied to an extraordinary extent. In adapting themselves to their new kind of life and environment they modified the characters of the original Spanish cattle which the conquerors had introduced into the new continent and formed the local or "criolla" breed.

In 1624 the nucleus of San Domingo de Soriana was founded on the coast of Uruguay it soon attracted a current of immigration from Buenos Aires for the purpose of hunting the wild cattle and the trade in their hides. The beef had no market value while the skins fethed 0.80 pesos (3s 4d) each and were sent to Buenos Aires or to Spain. In 1680 another settlement was founded, La Colonia, and the trade in hides increased. This state of things continued until the invasion of the Portuguese in 1723 when Montevideo was founded. Among the privileges granted to the settlers the following were included: a plot of land of 25 X 50 "varas" (70 X 140 feet) upon which to build a house, a field of 10 "cuadras" (18.22 acres) and a ranch of 1 "smerte de campo" equal to 4940 acres, besides which, each "estanciero" was given 200 head of cattle and 100 sheep. As the law did not prohibit the accumulation of land, which could be bought very cheaply, some enormous estates were formed, and even now there are some estates which include 10 "smertes de campo", (49 400 acres) entirely devoted to the breeding and fattening of cattle. In 1670 a decree of DON JOAQUIN DE VIANA, governor of Montevideo, forbade the great butcheries of cattle and allowed only bulls and oxen over 5 years of age and the male calves to be killed for butcher's meat. This law favoured the rapid multiplication of cattle which soon stocked the ranches of privated owners, of the Jesuits and of the Crown. FRANCISCO BAUZÁ in his *Historia* mentions two Royal "estancias", one 130 977 and the other 313 480 acres in extent. The Jesuits possessed 370 500 acres,

In 1754 was founded the first "saladero" (an establishment for the salting and drying of meat) but it met with poor success. In 1786 DON FRANCISCO DE MEDINA bought the "estancia real de Colla" and erected on it a large "saladero" for the utilization of all the principal products of the slaughter house, such as hides, flesh, tallow etc. As

many as 1000 head of cattle per day were slaughtered. Laws were passed for the protection of the new industry and "tasajo" or "jerked" beef began to be exported to Cuba and to Porto Rico. The animals which could be bought for 0.30 peso (1s 3d) when Montevideo was founded fetched five times as much after the erection of Medina's "saladero". At the beginning of the nineteenth century there were more than half-a-dozen "saladeros". The progress of the industry was suspended during the civil wars, but was continued afterwards and much improved.

Improvement of the cattle.—The improvement of the "criollo" cattle began in 1860 with the importation of Durham bulls. Later, this breed was used for breeding by itself, as well as for crossing with the local breed. It is much esteemed in Uruguay as it preserves its characters very well, and produces crosses which attain weights of 1100 and 1320 lbs. when fattened on the pastures. Their meat fetches as much as 2.1d per lb. live weight.

The importation of Herefords began in 1864. They are bred on the same system as the Durham to which they are preferred by many breeders, especially in the North of the Republic, because they are more suitable for the open country.

The Devon breed was introduced in the distret of Paysandu in 1874, it has not spread much, but has found a good market in the South of Brazil where it is imported to improve the native breed. Neither has the Polled Angus breed spread much, (in the district of Salto) notwithstanding the fact that it has become perfectly acclimatized and yields excellent meat. As the lasso is still used for handling the cattle, the lack of horns perhaps accounts for its limited distribution in Uruguay. The following breeds have also been imported: Polled Durham (in Paysandù); Ayrshire; Simmental (at Piriapolis); Jersey (at Toledo in 1887 where it is bred pure for the production of milk); Dutch (in the district of Canelones) already fairly wide-spread in the country; Red Flemish (in 1910); Black spotted Flemish (imported from Argentina in 1912). But of all the milk breeds the most widely spread is the "criolla", common in the whole of Uruguay. It has a lactation period lasting five or six months and yields about 1.32 gallons of milk per day.

TABLE I. — *Statistics of the live-stock in Uruguay.*

	1860	1900	1908
Cattle.	3 632 203	6 827 426	8 192 602
Sheep.	1 989 929	18 608 717	26 286 296
Horses	518 218	561 408	556 307
Mules.	8 301	22 992	17 671
Pigs	5 831	93 923	180 099
Goats	5 437	20 426	19 951

The rapid rise in the number of cattle in Uruguay is not due merely to the multiplication of the "criolla" breed but to crosses between this breed and the imported breeds. In 1887 the "Asociación Rural del

Uruguay" founded the Herd-book in which from that time up to 1913 the following have been entered :

	head		head
Hereford	9 000	Dexter.	15
Shorthorn	4 900	Simmenthal	23
Lincolnshire Red Shorthorn	18	Schwyz	7
Devon	134	Flemish spotted	7
Polled Angus.	226	" brown	7
Red Polled	54	Jersey	68
Norman	183		

To these numbers should be added that of the grade animals amounting to 157 859 head (1.93 per cent.); that of that of the cross-breds which amounts to 5 204 489 head (63.53 per cent.); that of the "criollos", or 2 690 788 head (32.84 per cent.); and that of the unspecified cattle or 139 466 head (1.70 per cent.).

In Uruguay there are 19 745 farms devoted exclusively to the raising of live stock, 18 602 purely arable and 5 527 of a mixed character.

Formerly all the animals ranged freely on the pastures, the limits between the various estates being marked only by a few boundary stones. The herdsmen ("peones de campo") mounted on horseback, used to ride round and round the cattle for several days and nights until the animals had grown accustomed to sleeping in one particular place called a "rodeo". It was there too that the animals were collected when required, and when a rounding up had been called, the herdsmen ("la peonada") went out into the open pastures with a few trained dogs; they emitted special cries at the sound of which the cattle gathered in the "rodeo". Later the properties began to be surrounded by walls; in 1875 wire fencing was introduced by law; the enclosures were made with five strands of wires fastened to hard wood posts ("mandubay") placed 20 metres (65 ft.) apart with five intermediate pine supports. After this the fenced or walled estates were subdivided into pastures, partly for the purpose of keeping the several kinds and breeds of animals apart. The improvement of the cattle led to greater care being taken of the animals. The owners increased the number of wires round the enclosures to prevent their stock from mingling with that of their neighbours. They are obliged now to brand their cattle and horses, and to mark their sheep, goats and pigs.

In 1877, with the assistance of the State, live stock shows and fairs began to be held, at first at intervals of a few years, then every year in some districts. At present they are very well organized over the greater part of Uruguay. The State contributes subsidies voted by the legislative body and divided among the various districts and societies; other prizes are offered by private persons. In 1895, together with the third national live stock show, the first rural congress was held.

Markets.—As has already been mentioned for 150 years (the so-called "hide period") the sole product of the Uruguay animal husbandry consisted of hides. In 1780 the salt meat industry began with the exportation of

TABLE II.

Year	Number of Shores	Subsidies voted £	Number of animals exported					Amount of sales £
			Sheep	Cattle	Horses	Pigs	Poultry	
1910	7	6 770	96 312	6 624	129	51	272	54 400
1911	21	11 100	50 943	25 137	421	205	741	147 000
1912	18	6 410	30 491	23 720	114	154	695	179 000

"tasajo" or jerked beef, to Porto Rico and Cuba which are still the chief consumers. This industry increased the price of cattle five fold in about ten years, from 1.50 pesos (6s 4 $\frac{1}{2}$ d) in 1777 to 8 or 9 pesos (34s to 38s 3d) in 1790, and caused a strong current of emigration from the towns to the country; since then animal husbandry has become the chief source of national wealth. Whilst the cattle was being domesticated and selected, the technique of the salt meat industry was also being improved with regard to the utilisation of the main and of the by-products, and, by yielding higher profits, allowed better prices to be paid for the cattle thus further stimulating their multiplication and improvement.

Together with the salt meat industry other industries arose. In 1885 the great meat extract factory belonging to Liebig's Extract of Meat Co. Ltd. (capital £500 000) was erected. At present the salting of meat is still carried on extensively, nevertheless it is gradually being replaced by other methods of turning the raw material to account, as may be seen from the following figures:

Value of products other than "tasajo".

Year	Pesos	£
1901	1 860 000	395 250
1905	3 022 000	642 175
1908	3 796 000	806 650

Considering the great development taken by the cold storage industry in Uruguay (it deals at present with about 400 000 head of cattle and 800 000 sheep), and the high customs duties on jerked beef in Cuba and in Brazil (exportation to this latter country has diminished by 3 000 000 pesos or £637 500 per annum), it is easy to foresee that before long the jerked beef industry will be very considerably reduced or will disappear altogether. While the output of the Uruguay "saladeros" diminishes continually, that of the Brazil "saladeros" is always progressing, as the following figures show:

Number of head of cattle killed in the "saladeros".

Year	Uruguay	Brazil
1908	467 000	597 000
1909	514 000	660 000
1910	576 000	503 000
1911	446 600	707 000
1912	435 600	902 000

TABLE III.

Products	Value	
	Pesos	£
Wool	63 589 932	13 512 860
Salted hides, (oxen and cows)	24 429 132	5 191 190
Dried " " " "	11 249 166	2 390 448
Salted " (calves)	77 295	16 425
Dried " "	1 312 839	278 978
Hides of unborn cattle	76 089	16 169
Sheep skins	8 940 065	1 899 764
Lambskins	211 751	44 997
Skins of unborn lambs	170 649	36 263
Salted horse hides	121 002	25 713
Dried " "	221 968	47 168
Coat skins	1 060	225
Unspecified skins	7 898	1 678
Salt meat ("tasajo")	22 699 072	4 823 553
Preserved meat	1 629 487	346 266
Extract of meat	6 725 550	1 429 179
Preserved tongues	816 828	173 576
Frozen meat	575 723	115 967
Frozen lambs	290 367	61 703
Meat, not specified	84 000	17 850
Fat	942 079	200 192
Tallow	7 932 243	1 685 602
Guano	551 617	117 231
Bones and bone ash	580 000	123 251
Hoofs	40 951	8 702
Neat's foot oil	20 000	4 250
Horns	93 238	19 813
Cheese	10 867	2 309
Tripe and sinews	237 129	50 390
Bladders	3 880	824
Other products, not specified	124 210	26 395
Horns of all kinds	722 421	153 514
Live animals	4 652 884	988 738

There are at present in Uruguay 16 "saladeros" 5 preserved meat factories and 2 cold storage establishments.

In 1904 the first cold storage works were erected in Uruguay with capital raised in the country itself. They can deal with 400 head of cattle and 4000 sheep daily. In 1904-05, that is, in its first year, 4302 head of cattle and 102 432 sheep were slaughtered. Last year 30 000 of the former and 300 000 of the latter were dealt with. In 1912 a second cold storage establishment capable of dealing with 700 head of cattle and 2 500 sheep per day began to work. A third is being built by a North American company with a capital of 4 million dollars.

The value of the animal products exported from Uruguay during the five years 1903-1907 amounted to about 160 000 000 pesos (£ 34 000 000) distributed as shown by Table III.

Institutions for the promotion of animal husbandry.— Two of these may be mentioned: "Inspección de ganadería y agricultura" (Inspection of Animal Husbandry and Agriculture) and the "Inspección sanitaria animal".

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT
OF AGRI-
CULTURE
IN DIFFERENT
COUNTRIES.

401 - **Report of the Government Commission for the Study of the Natural and Agricultural Conditions of Tripoli.** — *Tripolitania settentrionale*: Relazione della Commissione per lo studio agrológico della Tripolitania, nominata con D. M. dell'11 Febbraio 1913, presentata a S. E. il Prof. P. BERTOLINI, Ministro delle Colonie. Vol. I, pp. 1-431, Relazione; Vol. II, pp. 1-343, Studi complementari ed illustrativi; Roma, Ministero delle Colonie, 1913.

The Minister of State for the Colonies, having recognized the necessity of entrusting a commission of experts with the investigation of the vast problem of the improvement and utilization of land in Tripoli, nominated a Government Commission for the purpose by Ministerial Decrees of February 11 and 14, 1913.

The Commission reached Tripoli on March 1, 1913, and, after spending several months in the colony, forwarded its Report to the Minister for the Colonies, in the month of December of the same year.

The Report is in two parts. The first is the Report proper in which the territory of Tripoli, its agricultural possibilities and the social problem of colonization are considered. The second part contains complementary studies which throw light on the various questions dealt with by the first part.

The duties of the Commission were set forth clearly in the speech delivered by the Minister at its first meeting, when he pointed out that the systematic development of the Colony from the very beginning would depend to a great extent upon the conclusions of the Commission.

Having carried out its instructions, the Commission published at the end of its Report its general conclusions which are here given *in extenso*:

GENERAL CONCLUSIONS.

1. — That part of Tripoli examined by the Commission and to which the present conclusions refer (with the exception of some districts that could not be surveyed and which are named in the Report) is bounded,

as shown in the accompanying maps : on the north and east by the sea from Cape Arrár (great Syrtes) to the Tunisian border ; on the west by the western Jebel and the plain towards the same border ; and to the South by the high plateaux of the interior. The surveyors pushed, as far as Bir Dufán on the eastern plateaux, and into the Mselláta district ; they also visited the borders of the Jebel in the territories of Tarhúna, Garián and Ifren.

2. — The region consists of two prevailing morphological types :

a) large plains and steppes along the coast, with " sebkas " (1) formed by Quaternary and recent deposits, prevailing sandy, with dunes and hills of stratified rocks belonging to the Secondary and Middle Tertiary formations ;

b) the belt forming the edge of the plateaux consisting mainly of stratified cretaceous formations, tabular in form and slightly dipping to the south ; and, in the eastern part, the Miocene appears and is likewise stratified. A layer of sandy soil covers these plateaux discontinuously, masking to a certain extent the irregularities of the rocky soil.

3. — The climate is warm, temperate, and dry. The yearly rainfall may be considered, at least along the central coast, as being above 420 mm. (about 16 $\frac{3}{4}$ inches). On the plain it diminishes in frequency and in quantity from the coast to the foot of the plateau, whilst on the border of the plateau itself the rainfall is more abundant than on the coast.

Owing to the beneficial effect of the maritime climate, which partly neutralizes that of the Sahara, the flora of the coast up to the edge of the Jebel is of a prevailing mediterranean character. Vegetation presents a striking contrast during the two periods autumn and winter, and spring and summer, being fairly rich during the former and poor and dried up during the latter. Many types of plants are found, from those most characteristic of arid regions to those common in moist and marshy localities. The most distinct plant formations are the *steppe* on the plains and plateaux and a *pseudoscrub* on the hill and mountain slopes. The former is especially noteworthy on account of its extent and because it expresses accurately the complex conditions present in the soil.

There are three belts of vegetation ; the maritime or mediterranean, the pre-desert or transition, and the desert vegetation which appears only in the southern part of the plateau. In the pre-desert belt the Alfa-grass steppe is important ; it is much reduced or has disappeared altogether in the maritime belt.

4. — There are few superficial streams and no permanent water courses of any importance, with the exception of those originating in the great sources of Taurgha. But the flood waters of the wadies could be utilized for flooding extensive tracts of land and if collected in tanks for watering live stock, and for a limited amount of irrigation especially of new plantations.

Barrages across valleys for the formation of great reservoirs seem to be less suitable.

(1) A dry area or bed of a lake incrustated with salt ; a salt marsh.

(Ed.).

Almost everywhere in the coastal plains one or more water bearing strata are found, often with somewhat brackish water. The phreatic water table, the only one hitherto utilizable for irrigation, is found at depths varying from a few inches to 50 or 66 feet in the belts nearest the coast, and generally sinks deeper as the distance from the coast increases until in the higher Gefara district it lies at depths of above 260 feet. Its volume is limited and varies from one locality to another, being in general greater in the belts nearer the coast.

As for artesian wells no definite data is as yet available except at Misurata, where the water rises at most from a depth of 280 feet to within 8 ft. 8 in of the surface, but in no great quantity.

5. — The substratum of the surface of the quaternary and recent formations is formed, in the pre-Garián hills, by compact limestones, often flint bearing, and prevailingly marly, also by quartzites and sandstones; and in the Jebel by numerous varieties of limestones, by dolomites, sandstones, marls, gypsum, clay and also eruptive rocks. These various beds of rocks will afford building materials for all purposes.

The coastal plains are fundamentally constituted by a stratum of fine red quartz sand (with *Helix*); in the coast belt, it is found between two beds of sandstone and in some places is covered by white sand dunes, prevailingly calcareous. In the interior the plains consist of large tracts of continental dunes — shifting or consolidated — formed of similar fine reddish quartz sand. The same stratum contains localized and irregular layers of calcareous sand embedded in or lying on the surface of the red sand.

6. — This type of soil, namely the red sands (with *Helix*), occupy the greatest area; they form the soil of the steppes and of the oases and the basis of the masses of dunes; they predominate also in the surface layers of the rocky soil of the hills of the plateau. In general they form the layer bearing the phreatic water and give rise to the soil essentially and immediately utilizable for agriculture.

It appears difficult to bring the soil of the “sebkhas” under cultivation, at least for the present.

As for the shifting dunes, steps will have to be taken to fix them in those places where they are dangerous to centres of population, roads, railways and cultivated lands. The means of fixing them have been studied in the Report.

7. — The agricultural soil, as mentioned above, is generally formed by the quaternary red sand, mostly wind blown and granular in structure, with a tendency to uniformity; it is coarse grained in the agricultural sense, silicious or silico-calcareous and generally deep.

Its productivity is intimately connected with the amount of water which it contains. When this is sufficient the soil is favourable to all plants grown in the warm temperate zone and can yield heavy crops.

8. — The rainfall being scanty, a sufficient amount of moisture cannot be had without irrigation. Nevertheless by flooding the land in the autumn and winter with the water brought down by the torrents, a satisfactory yield

can be obtained from plants whose life cycle lies between autumn and spring.

On the other hand, with perfectly dry cultivation, some trees can be profitably grown, such as olives, almonds, vines, carobs, prickly pears, besides any cereal, such as barley, provided suitable systems of cultivation be adopted.

9) At present the following types of holding exist :

a) *Irrigated garden holdings*, in which fruit trees and field crops are grown together in small holdings, either worked by the owners themselves or let on the share system. They are generally collected together into large or small groups (oases) situated mostly along the coast and but rarely in the interior.

b) *The large enclosed dry holdings*, in which fruit trees are exclusively grown or in which olive groves are intermingled with cereals; in both cases winter flooding is almost always resorted to. These farms are most frequently situated in hollows in the hills.

c) *Plantations*, in which olives and figs are grown, without any form of irrigation, either alone or together with cereals. They are found especially in the mountainous districts as in Msellâta and the Gariân.

d) *Badia land*, that is the steppe utilized as pasture and, to a limited extent, for the desultory cultivation of cereals.

e) *The wadies* where, in special cases, cereals are grown almost continuously.

10. — Considering the complex conditions of the country, it is evident that the land will only be brought under cultivation partly by observing the greatest economy in utilizing all the available water, and partly by adopting dry farming methods.

With regard to the utilization of subterranean fresh water at no great depth, it will be possible to extend irrigation farming in several localities of the country described in the Report. Thus it may be calculated roughly that, in the limited area examined by the Commission, besides the existing oases, at least 74 100 acres of land can be irrigated. It will also be necessary to study the possibility and the means of utilizing the important springs at Taurgha the water from most of which now runs to waste. It will also be possible to extend the flooding system in many depressions of the hills, and it will be advisable to investigate the possible utilization on the plains of water from the torrents which now flow into the sea.

On almost all the rest of the cultivable area profitable returns can be obtained from the plantations and field crops mentioned above as being suitable to dry lands, provided they be treated on a rational system.

On that part of the steppes which will not be brought under cultivation, animal husbandry can be improved, especially with regard to sheep raising, so as to render it more profitable than it is at present. The first necessary steps to be taken are the provision of a water supply and the organisation of a sanitary police.

II. — It appears thus, that over the greater part of its area, the

country examined by the Commission is suitable for agriculture and consequently for some form of colonization.

This conclusion is reached, not only by a study of the factors which contribute to form the physical environment, of the spontaneous vegetation and of existing farming conditions, but also by comparing the country with central and southern Tunis where agriculture has greatly developed and where the general conditions, though similar, are less favourable than those of Tripoli.

12. — No colonisation undertaking should ignore the native methods of farming, both in the dry and irrigated lands, for they are the result of centuries of practice.

The types of holdings which might most advantageously be selected by future colonists are the following :

a) Irrigated holdings, within the above mentioned areas, for very intensive cultivation and with the production of early fruit and vegetables as well as various industrial plants.

b) Completely dry or periodically flooded holdings of considerable extent, 500 or 750 acres, in which a mixed system of farming should be adopted namely plantations and field crops.

c) Pastoral holdings, based chiefly on sheep farming and consisting of a farm or central nucleus and a variable area of steppe for grazing purposes.

Dry enclosed holdings may also be adopted under certain circumstances by colonists, but this type of holding seems to be the least suitable.

13. — In general it seems advisable to employ chiefly native labour, especially unskilled labour. Consequently colonization will have to be brought about by the association of Italian capital and management with native labour, either on land which has become the property of the Italians or on land belonging to the Arabs. Such association seems especially indispensable for some types of farms such as the dry enclosed farm, the pastoral farm and the mixed plantation and field crop farm. In special cases all the work might be performed by Italians.

Other forms of association between colonists and natives will no doubt develop with practical experience.

14. — In order to enable the work of colonization to proceed regularly and relatively rapidly it appears necessary :

a) to prepare plans of colonization in determined localities and on lands that present a variety of conditions and to which different agricultural systems may be applied according to the different forms of land tenure. Further, a detailed survey of the country such in its present condition must be made ;

b) to carry out a large number of practical experiments, directed by a State Agricultural Bureau situated in the colony. The details of the experiments will be found in various parts of the Report.

15. — It will be advisable to entrust some of the above mentioned colonization experiments to associations and to private undertakings, and also to allow both natives associated with Italians or Italian purchasers full

liberty to undertake colonization schemes on land ascertained to be private property.

16. — Lastly a recommendation is made to continue the investigation of the vast territory to the south of the country dealt with by the Commission, in order to ascertain the extent and the characters of the land suitable for colonization — on the existence of which very incomplete data are at present available — and also to discover whether there exist minerals or vegetable products in sufficient quantities to enhance the economic value of Tripoli.

402 — **Popular Agricultural Education in Hungary.** — BALKÁNYI, B. in *Mezőgazdasági Szemle*, Year XXXII, Part. I, pp. 1-7, and Part 2, pp. 67-72. Budapest, January and February, 1914.

The first step towards popular agricultural education in Hungary dates back to 1868, year in which the law XXXVIII made by the eminent statesman, Baron JOSEPH EÖTVÖS came into force. This law made it compulsory that the first principles of agriculture should be taught in primary schools. It remained however a dead letter.

In 1896, an Order of the Minister of Public Instruction made agricultural education the chief object of the complementary schools, or so-called "repetition" schools, and with the help of the Minister of Agriculture, regulations were made for their organization and curriculum. At the same time the agricultural instruction of school teachers was provided for, and subsidies were granted to cover the extra fees received by the teachers from those local governments which were willing to undergo the expense attendant upon the creation of these schools. According to the above Order all communes in which the greater part of the inhabitants were engaged in agricultural pursuits and whose primary schools possessed more than one teacher, were obliged to institute these rural complementary schools. The said Order regulates the amounts of the grants, the hours of instruction, makes compulsory the attendance of boys between 12 and 15 years of age, establishes the locality of the schools, nominates their teachers and provides for their inspection. It was thus only in 1896 that compulsory popular agricultural education began in Hungary, and it met with numerous obstacles from the start. In order to prepare the rural teachers the Ministry instituted some summer agricultural courses for them, which were attended every year by several hundreds of teachers. Besides this, immediately after the publication of the Order, it was decided that some teachers should receive a more thorough agricultural training and to this end each year 12 to 15 rural teachers, holding scholarships, were sent to agricultural colleges for two years after which they were appointed as special teachers in the complementary schools of the large communes and entrusted with the management of a model farm.

Thus from the outset elementary agricultural instruction was imparted in two types of schools: 1) The agricultural complementary school attached to the primary day school in small communes, where the teacher of the day school is also entrusted with the teaching of agriculture and with the care of the garden, nursery, market garden and vineyard; 2) the type of school

for the large communes and including two degrees: a) complementary agricultural courses at the primary dayschools; b) independently organized elementary agricultural schools with specially trained teachers who have attended a two year's agricultural course (1) and who manage a school farm of about 28 $\frac{1}{2}$ acres, the land and the original equipment of which are supplied by the respective communes. During the last 17 years, these schools, especially those organized independently with special teachers, have specialized according to their districts and devoted themselves more particularly either to general farming, vine-growing, fruit and vegetable growing or to forestry.

The communes having supplied the school farms with their original equipment in live and dead stock the upkeep of these schools is defrayed by fines inflicted for unjustified absence, by 80 per cent. of the net returns of the experiment fields (20 per cent. being due to the teachers), by the interest of the foundation fund (if there is one), by the sum voted by the commune and by State grants.

In 1902 the rural complementary schools received State grants amounting to £6250; in 1912 these amounted to £25 331 for ordinary expenses and £13 125 for extraordinary ones.

The number of students has also increased. The organization of new schools is chiefly due to the initiative of the Government and very rarely to agricultural associations. Though the results hitherto obtained are not satisfactory, for out of the half million children subject to compulsory education the greater part of whom are children of small farmers, only 15 000 to 16 000 attend the independent elementary agricultural schools, the efforts and the zeal of the Government deserve high commendation, as it has to contend with the indolence of many communes who use every means in their power to free themselves from the duty of establishing these elementary agricultural schools. To remedy this state of things the writer proposes that the Government should adopt more stringent measures to oblige the communes to found such schools and to endow them with the land required for their experiments, and, at the same time, that the complementary schools attached to primary schools be converted into elementary agricultural schools.

403 - **The Institute for Agricultural Botany and the Institute for Seed Selection in Bavaria.** — I. HILTNER, L. in *Landwirtschaftliches Jahrbuch für Bayern*. Year 3, No. 13, pp. 726-741. Munich 1913. — KRIESSLING, L. *Ibid.*, pp. 842-756.

I. The writer gives an account of the work of the Royal Bavarian Institute for Agricultural Botany which includes departments for seed control, soil bacteriology, field experiments, and plant protection. Amongst other things, the Institute established, a year ago, the practice of applying a lead seal to sacks of clover and grass-seed destined for the market. These seeds are first thoroughly examined, and the Institute is thus able to guarantee that they possess the characters set forth.

(1) There is at present a much esteemed primary Normal State School for teachers at Komáron, which turns out every year about 15 specially trained teachers.

The manuring experiments carried out throughout the kingdom are directed by the Institute, the staff of the latter being assisted by the State Instructors in Agriculture.

The sale of poisoned grain for the destruction of field mice, is not a monopoly of the Institute. The course of the mouse plague during the last 10 years is now being worked out cartographically by the Institute.

II. The Institute for seed selection in the Kingdom of Bavaria now possesses 56 branches in various parts of the country where plant breeding is carried out. The Institute has founded Agricultural Associations throughout Bavaria, in order to encourage arable farming and holds annual shows, where prizes are given for the best produce. Field variety trials are carried out under the direction of the Institute.

AGRICULTURAL
INSTITUTIONS.

404 - **Union of Women's Agricultural Associations in Prussia.** — *Zentralblatt der Preussischen Landwirtschaftskammern*. Year 13, No. 10, pp. 76-77. Berlin, March 9, 1914.

At a meeting of the Provincial Unions of the Women's Agricultural Associations of Prussia held in Berlin on February 15, 1914, it was decided to found a Prussian National Union of Women's Agricultural Associations with its seat in Berlin. The object of this National Union, is according to its statutes, the creation of a centre for the work of the Provincial Unions, and of a body representing their common interests, especially with regard to the following questions:

1. The teaching of domestic science.
2. Increasing of the productivity of the rural domestic industries by organising the sale of fresh produce in towns.
3. Promotion of fruit growing and market gardening, of bee and poultry keeping and of other branches of rural domestic economy.
4. Control of emigration from the country.

AGRICULTURAL
SHOWS AND
CONGRESSES.

405 - **Agricultural Shows.**

Belgium.

1914 Nov. 28-30, Ghent. — Yearly Poultry Show organized by the "Het Neerhof Association". Address to M. Heindrix, Secretary, 3 Rue du Saint Esprit, Ghent.

Dec. 12-14, Liège. — Great International Poultry Show organized by the "Union avicole de la province de Liège". Address to G. Wodons, Château de Lourin, Aus (Belgium).

France.

1915 — Competition of flax growing, organized by the "Comité linier de France". Prospectus on application to Albert Durand, Secretary of the "Comité linier", 15 Rue du Sec-Arembault, Lille (Nord).

1914 June 27-July 7, Rosny-sous-Bois. — General "Horticultural Show" organized by the Vincennes Horticultural Society. Address to E. Pacotto, president of the organizing committee, 11 Rue de la Marseillaise, Vincennes.

1915 Paris. — International show organized by the Horticultural Section of the International Exhibitions Committee.

1915 Jan. 9-11, Lille. — International poultry show. Apply to M. Desreumaux, 92 rue Franklin, Roubaix (Nord).

Germany.

1914 June 17-19, Marienburg (West Prussia). — Fair for saddle and carriage horses.
July 4-8, Görlitz. — Agricultural and Live Stock Show.

Hungary.

- 1914 July 25-30, Presburg (Pozsony). — Apicultural Show held under the auspices of the Ministry of Agriculture in connection with the fifty-ninth meeting of the Germany, Austrian and Hungarian bee-keepers. Address to J. Valló, director of the exhibition, 13 Duna, Pozsony.

Italy.

- 1914 June, Noto. — Oenological and ampelographical Show held under the auspices of the "Reale Cantina sperimentale" on the twenty-fifth anniversary of its foundation.
June 15-Sept. 15, Turin. — International Show of Apicultural Produce, held under the patronage of the International Museum of Apiculture and Sericulture at Turin. Address to the Management of the Museum, 44 Via Carlo Alberto, Turin.

406 — **Agricultural Congresses.***France.*

- 1914 October, Reims. — Third French Cold Storage Congress held by the "Association Française du Froid." The congress will be divided into the following sections: 1. Liquefied gases and frigorific plant; 2. Cold storage applied to agriculture and to foodstuffs; 3. Cold storage applied to the industries; 4. Transport in cold storage; 5. Legislation and education; 6. Cold storage applied to hygiene and medicine.

Hungary.

- 1914 July, 25-30, Presburg (Pozsony). — Fifty-ninth meeting of German, Austrian and Hungarian Agriculturists.

Russia.

- 1915 August 8-14 (July 26-August 1, Russian calendar), Saint Petersburg. — Ninth International Congress of Applied Chemistry, organized under the presidency of Prof. P. Walden, Riga. The fifth section of the Congress will deal with the chemistry and technology of sugar. The seat of the organizing committee is at the Laboratory of the Association of Russian Sugar Manufacturers, at Kiew, Meringowski, 3.

Spain.

- 1914 July 20-August 9, Barcelona. — Eighth International Congress of Commercial Expansion, divided into three sections: a) Economic and Social Spain; b) Artistic Spain, c) Spanish America.

Switzerland.

- 1914 June 8-10, Berne. — Sixth international dairy congress. — 1st section, hygiene; 2nd section, chemistry and bacteriology; 3rd section, dairy economics; 4th section general trade. Apply to Prof. Burri, Secretary-General, Berne.

United States.

- 1914 October 7-17, Wichita, Kansas. — Eleventh Dry-farming Congress.
1915 September 20-25, San Francisco. — International Congress of Mechanics held during the International Exhibition in connection with the opening of the Panama Canal.

CROPS AND CULTIVATION.

- 407 — **Is the Earth Drying Up?** — GREGORY, J. W. (University of Glasgow) in *The Geographical Journal*, Vol. XLIII Nos. 2 and 3, pp. 148-172 and 203-308. London, February and March, 1914.

AGRICULTURAL
METEOROLOGY.

The writer reconsiders all the evidence on which rests the view that the earth is progressing towards desiccation, and discusses the conclusions founded on the facts. He first distinguishes between climatic changes which occurred in geologic times and those which have occurred in historic times, and, limiting his enquiry to the latter, Palestine is taken as a good example

of a country said to be exhibiting desiccation. Here, however, when the available records dealing with the range of the date palm and the vine are examined, and from other facts recorded by the old Testament writers, no change of climate is indicated, and, moreover, the balance of expert opinion is not in favour of such a change. The same may be said of Egypt. The evidence of climatic changes is next examined in Greece, Cyrenaica, Northern and Western Europe, Hungary and Roumania, Central and Western Asia, Africa, North America and Greenland, with the result that the writer reaches the following conclusion: there may have been widespread climatic changes in late geological times, but in historical times there has been no world-wide change of climate.

"Geological evidence shows how the passage from the climate of the Glacial Period to that of our own day has proceeded on two main lines. In some countries there has been a gradual rise in temperature since the disappearance of the ice, accompanied either by an increase or decrease in humidity. In other countries the glacial conditions were succeeded by a warm dry period, followed again by wetter conditions. This increased humidity characterises the present climates of Scandinavia, Germany, Hungary, Roumania, the eastern and southern part of North America, parts of Africa from Nigeria to Cape Colony, and there is some evidence of the same change following a dry, post-glacial period in England. As an increased rainfall has been demonstrated for so many parts of the world, it is only natural to expect a compensating decrease in other districts; and there is accordingly a predisposition to accept the claim that central Asia is suffering from increasing desiccation.

"Yet it is well to remember that the extent of such a change may be easily exaggerated by attributing to recent climatic changes the effects of prehistoric variations. For archaeological and historical evidence shows that Central Asia, and even the coasts of Persia and Beluchistan had a very arid climate in the earliest times of which we have human records, that the Caspian Sea was at least as small and as low in the fifth century as it is now, that the African and Asiatic deserts are in places again passing under cultivation. Though it must be admitted that, while there is a strong balance of opinion in favour of the view that the aridity in Asia is being still increased, there are weighty authorities on the other side.

"The explanation of the conflicting views may be that in central Asia the desert is widening in some places and contracting elsewhere. That the total rainfall in central Asia has diminished is, however, probable as an accompaniment to its increase in parts of Europe. Variations in the distribution of rainfall must result from any considerable alteration in the level of the land; the uplift of a continent must cause the rainfall to become heavier on the margins and lighter in the interior. The increase of rain on the coastlands would however hasten their lowering by denudation, and again the rain would sweep over the interior; hence the geographical equilibrium, unless checked by renewed uplifts of the coastlands, would restore in time the more even distribution of the rain and revive the desolate regions in the heart of a continent".

- 408 - **The Economic Value of Tropical Rains.** — CAPUS, G. in *Annales de Géographie*, Vol. XXIII, No. 128, pp. 109-126. Paris, March 15, 1914.

Systematic analyses of the nitric and ammoniacal nitrogen in the rainfall were carried out at Hanoi, Tonkin, during the eight years 1902-1909.

The total nitric nitrogen brought down by the rain was found to vary considerably from year to year, the two extremes being 14 lbs of nitric acid per acre in 1908 and 64 lbs in 1902, with a mean of 43 lbs over the whole period. The average brought down for each month was closely associated with the average number of days on which thunderstorms occurred, and it was found that the nitric acid content of the rain water was higher in the lighter thunder showers (5 parts per million) than in the heavy downpours, and lowest of all in the winter rains (0.1 to 0.3 parts per million). The annual rainfall over a longer period varied from 39.4 in. to 103.4 in. with an average of 66.9 in. Monthly averages reached a maximum during the summer months, July and August, at which time the maximum amounts of nitric acid were also brought down.

The ammoniacal nitrogen also varied within wide limits, not only with regard to the total amount brought down per acre per annum, which showed a maximum of 17 lbs and a minimum of 4.5 lbs, but also in the various samples of rain water in which the content of ammonia oscillated between 0.1 and 1.8 parts per million.

- 409 - **The Presence of Some Benzene Derivatives in Soils.** — SHOREY, E. C. (Bureau of Soils, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 357-363, Washington, February 16, 1914.

Benzoic acid, metaoxytoluic acid and vanillin have been isolated in a pure form from the sandy soils of orange groves in Florida. The samples, which consisted of eight soils and their subsoils, were treated with a 2 per cent. caustic soda solution for 6 hours, after which the filtrate was shaken up with ether and the compounds went into solution in the ether. Benzoic acid was found only in one subsoil, and metaoxytoluic acid, though present in several of the soils, only occurred in any quantity in subsoils. Vanillin was found in four out of the sixteen samples. It is estimated that the substances are present in quantities equal to 350 lbs of benzoic acid, 800 lbs of metaoxytoluic acid, and 40 lbs of vanillin per acre in the top 12 inches of the soils investigated.

- 410 - **The Bacterial Treatment of Peat.** — BOTTOMLEY, W. B. (King's College, London) in *Journal of the Royal Society of Arts*, Vol. LXII, No. 3199, pp. 373-380. London, March 13, 1914.

Raw peat was first treated with a culture solution of an aerobic organism which has the power of converting humic acid into soluble neutral humates, and was then sterilized and inoculated with *Azotobacter chroococcum* and *Bacillus radicola*. The resulting material, so called "bacterised peat", contained up to 2.7 per cent of soluble nitrogen and 4.3 of total nitrogen, and had a remarkably stimulating effect on plant development when tested on various potted plants and small plots during 1913.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY.

411 — **The Question of Soil Maps.** — GRAF ZU LEININGEN, in *Naturwissenschaftliche Zeitschrift für Forst und Landwirtschaft*. Year 12, Part 3, pp. 114-122. Stuttgart, March 1914.

The problem of mapping the soil occupies most civilized states at present, but its solution is still distant. The main reason of this is that the maps must satisfy very various demands. Above all they must be of use to practical farmers and foresters.

The writer mentions the high scientific value of the maps of Prussia and Saxony, but complains that they are of much less use to the practical farmer and forester than they are to the geologist. Better but in no wise perfect are the maps of Württemberg which, it is true, do not profess to be maps of the soil. Their chief disadvantage is lack of clearness. By the use of parallel maps ("Parallelkarten") such as have been introduced by the Royal Hungarian geological Institution this defect could be remedied.

The writer points out the advantages that such maps could have for the farmer. But if the requirements of practical men are to be considered, then they must collaborate with the representatives of applied sciences. In future also more attention should be paid to petrography than has hitherto been the case. The scale should never be smaller than 1 to 25 000.

412 — **Irrigation and Drainage in the United States.** — *The Engineer*, vol. cxvii No. 3031, p. 117. London, January 30, 1914.

The United States Reclamation Service has yielded very satisfactory results with regard to economy and efficiency of work.

The service has expended some £15 000 000 and is now spending about £500 000 per year. Works are being constructed to supply water to about 3 000 000 acres and 1 200 000 acres are already supplied at a cost of £10 to £12 per acre. The Elephant Butte dam now being built on the Rio Grande at a cost of over £500 000 will supply water to lands on both the American and Mexican sides of the river. Many other large dams for mountain reservoirs are under construction. There are also numerous private projects being carried out. That of the Medina Irrigation Co. in Texas has 25 miles of canal from a diversion dam in the Medina River to a tract of 60 000 acres. This crosses the river twice by armoured concrete inverted siphons, each with twin tubes 8 feet in diameter. The South San Joaquin project includes the Goodwin dam (80 feet high and 460 feet long) on the crest. In several States underground waters are being used for irrigation, mainly in the plains; the pumping being done by petrol engines or electric motors.

The drainage of swamps offers a continuous field for engineering work but mainly as private projects. Some of the drainage is by gravity flow to streams, in other cases by pumping, and by vertical drains through impermeable strata to reach underlying permeable ones. Vast drainage projects are being scientifically and systematically undertaken in Florida.

413 — **Land Reclaimed in the Province of Ravenna, Italy.** — *Il Monitore Tecnico*, Year XX, No 6, p. 119. Milan, February 28, 1911.

Recently the water of the second large drainage canal, the Vela canal, has been introduced into the new main canal on the right of the river Reno.

As a result of this work another extensive area, about 51 870 acres, of the lower Ravenna plain have been reclaimed. Of these, 9 850 were always submerged and 19 760 were only intermittently drained.

The area of the lower Ravenna plain below the Aemilian road between the rivers Sellaro and Lamone is about 164 230 acres; 57 800 have already been reclaimed, there remain thus still about 56 800 to be drained.

The work was begun by the State in 1904 and will be completed in 1915.

Its total cost will be about £600 000 of which about one half has been spent. Agriculture is extending on the reclaimed land while malaria is gradually disappearing.

414 — **The Hindia Barrage on the Euphrates.** — *The Engineer* Vol. CXVII, No. 3030, pp. 87-89. London, January 23, 1914.

Sir William Willcocks was deputed by the Turkish Government in 1909 to visit Mesopotamia with a view to devising means for reestablishing the irrigation of that country, and presented a lengthy report at the end of 1910. He proposed that an expense of £150 000 000 be incurred on an extensive scheme of barrages, canals and other irrigation works. It was decided to proceed little by little and to construct first of all a barrage across the Euphrates so as to restore water to the Hilla channel which was almost completely silted up and which once served a wide area of very fertile land reaching nearly to the ruins of Babylon.

The work was commenced in February 1911 and completed in December 1913. In 2 years and 10 months a diversion some 5000 feet long with a barrage across it was constructed; the original channel of the river was dammed up and the water was turned into the diversion, a head regulator being built for the Hilla channel; a lock was erected and a new channel cut so as to convey water from the river to a point in the channel beyond where the silting up had occurred.

The accompanying map shows the site and general lay out of the works.

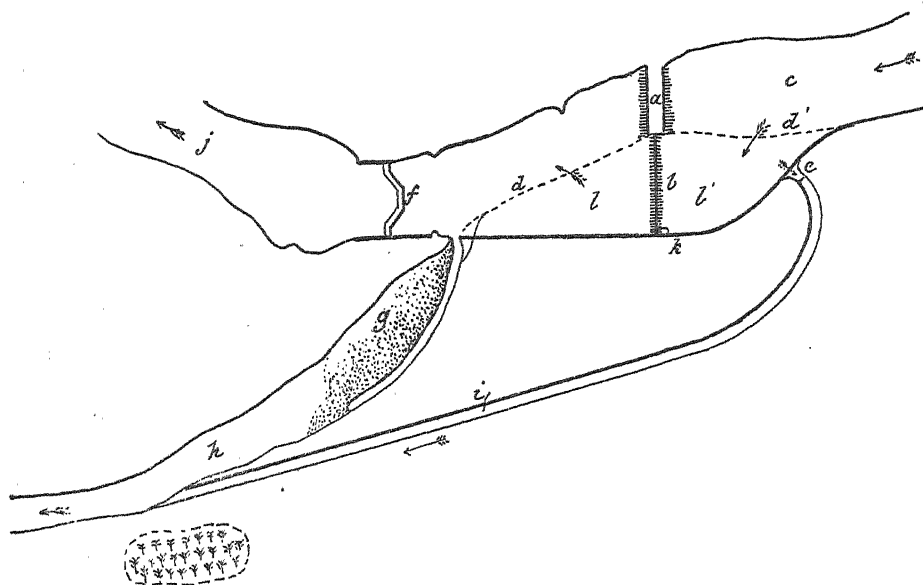
The barrage was so built that no portion of it came in the original bed of the river. It was wholly constructed in the dry when entirely finished, the new bed was excavated up and downstream, the river bank was demolished and a dam was erected across the old channel.

The ground on which the barrage was erected was composed of fairly hard silt; it was not deemed necessary to excavate the foundations to any great depth. Under the actual barrage the concrete put in was 3 ft. 3 in. thick and 72 ft. 2 in. wide, throughout the whole length of the barrage (779 ft. 2 in.). On this, brickwork was built to a depth of 6 ft. 7 in. and a width of 65 ft. 7 in., thus forming a foundation for the piers of the barrage.

The whole area covered by the works including the lock was enclosed by a complete fence of interlocking steel piling, and, further, a line of the same piling was run right across the pitching on the downstream side of the barrage. Upstream a stone pitching 32 ft. 6 in. wide and about 3 ft. 3 in. deep was laid on clay puddle. Below the barrage the pitching is 6 ft. 6 in. thick for the first 65 ft. 7 in. *i. e.* up to the transverse line of sheet piling already mentioned, and beyond this, pitching 3 ft. 3 in. deep

is laid on puddle for a distance of 72 ft. to a subsidiary barrage or weir across the channel. Beyond this again there is a brick work apron for $57\frac{1}{2}$ ft. and finally $65\frac{1}{2}$ ft. of pitching.

The barrage itself has 36 openings each 16 ft. 5 in. wide. The piers are are of brickwork 4 ft. 10 in. wide divided into three series of twelve each by two piers 11 ft. 2 in. wide. Their upstream face is vertical and the down-



- | | |
|---|--|
| a) denotes the new earthen dam across the channel of the Euphrates (c). | g) Silted up portion of Hilla branch (h) |
| b) New Hindia barrage. | i) Hilla branch diversion. |
| d, d') Original line of bank. | j) Hindia branch. |
| e) Head regulator for the Hilla branch (h). | k) Lock. |
| f) Old Hindia barrage. | l, l') Portions excavated after completion of new barrage. |

stream face built with four steps which reduces the thickness from 43 ft. at the bottom to 36 ft. at the top. The piers are all joined at the top by brick arches springing at 19 ft. 6 in. Above the arches there is a gangway 12 ft. 4 in. wide as well as two continuous walls 9 ft. 2 in. above the arches for carrying the winch to work the sluices.

There are two sluice gates in each opening, each gate being 17 ft. 3 in. wide and 8 ft. 7 in. high. At one side of the barrage a lock has been formed 26 ft. 3 in. wide and 341 ft. long.

The Hilla head regulator is very similar to the main barrage but it has only six openings, each 9 ft. 10 in. wide. It is provided also with a navigable opening 26 ft. 3 in. wide.

The main barrage will raise the ordinary summer level of the river some 16 ft. 6 in. which will allow an ample supply of water to be diverted into the Hilla channel.

415 - **Growing Crops in Western Nebraska.** - SNYDER W. P., BURR W. W. and BURNETT, E. A. in *Bulletin of the Agricultural Experiment Station of Nebraska*, No. 135, pp. 5 to 41. Lincoln, Nebraska, April 1913.

TILLAGE AND
METHODS OF
CULTIVATION.

The experiments carried on at the North Platte Experiment Substation since 1903 on crop rotation and methods of tillage point to the following conclusions:

1. Land cultivated in the summer when sown to winter wheat, has produced an average of 10 bushels more than twice the crop produced on land not summer tilled.
2. Turkey Red and Kharkov wheats have given the highest yields.
3. During a shortage of moisture thin seeding of winter wheat on summer tilled land has given the best results.
4. Seeding winter wheat by September 15, except in dry years, has given the best average results in this locality.
5. Early seeding of spring wheats has given the best average yields.
6. Spring grains have given a heavier yield on summer tilled land than on land not summer tilled, but only in the case of barley has it been at all possible to summer till for spring grains.
7. Seeding oats, barley and emmer at the rate of 6 pecks per acre has given the best results.
8. In all spring grains the earlier varieties have given the best average results.
9. Durum wheat and barley have produced more feed per acre than any other spring small grains.
10. Ordinary sorghum has proved the best annual forage crop.
11. Brome grass has not proved profitable either as a pasture grass or as a hay crop.

The climate of Western Nebraska is classified as semiarid or subhumid and it varies from year to year from almost humid to almost arid extremes with a mean annual rainfall of 18.5 ins.

416 - **Manurial Experiments on a German Estate in China.** - In *Kali*, Year VIII, pp. 149-152. Halle a. S., March 15, 1914.

MANURES AND
MANURING.

An account of the experiments carried out in 1911-1912 at the German-Chinese Agricultural School at Tsingtau. Dr. WAGNER points out in his report the great importance of fertilizers to Chinese agriculture in spite of current opinions to the contrary. Ninety per cent. of the population in China are agriculturists, and in many parts of the country the soil consists of the very best kind of strong loam, yet it would appear from evidence collected on the subject that the yields are not as large as in other countries, though there are no available official statistics to confirm the point. An analysis of a Shantung soil carried out by Prof. WOHLTMANN showed that the Chinese soil contained more nutrient substances than a normal German soil *i. e.*:

phosphoric acid	0.1 per cent.
potash	0.1 " "
lime and magnesia	1.0 " "
nitrogen	0.1 " "

The chief defects of Chinese tillage are a too superficial cultivation and insufficient manuring. For thousands of years night soil and sweepings have proved the only source of manure, and the Chinese agriculturists have had to make up the deficiency by taking such care of their crops that their system of farming amounts to an extended form of market gardening. With a more ample supply of manure this extensive use of hand labour in the fields would have produced double the crops. Stock raising should prove a help, but is only practised to a slight extent at present, and while awaiting its further development, dressings of fertilizers and deeper cultivation should do much towards increasing yields.

In the manurial trials in question, applications of about 2 cwts. of nitrate of soda, 3 cwts. of superphosphate and 2 ½ cwts. of 30 per cent. potash salts caused a considerable increase of the crop in all cases, varying from 20 and 25 per cent. for peas and beans to 55 per cent. for potatoes and 100 to 150 per cent. for cereals (wheat, barley and maize).

417 - Sodium Chloride as a Manure; New Investigations Carried out in Sweden.

1. SÖDERBAUM H. C. in *K. Landbruks-Akademiens Handlingar och Tidskrift* 1912, p. 21.
- BOLIN P. *Ibid.* 1913, p. 585, Stockholm.

The use of sodium chloride as a manure has been largely abandoned since it became known that neither sodium nor chlorine were essential plant foods, yet recent experiments in Sweden in which it has been employed have yielded very encouraging results.

Prof H. C. SÖDERBAUM, director of the Chemical Section of the Swedish Central Experimental Station, carried out a series of pot trials whose results are given in Table I.

TABLE I.

	Yield in gms.			Percentage increase in yield			Number of grains gms.	Weight of 1000 grains gms.	Ratio, straw grain
	total	grain	straw	total	grain	straw			
No nitrogen	18.8	5.6	13.2	—	—	—	132	42.6	2.34
Nitrate of soda . .	56.8	17.3	39.5	100.0	100.0	100.0	353	49.0	2.28
» + sod. chloride	63.2	22.0	41.2	116.8	140.1	106.4	452	48.6	1.88
Ammon. chloride . .	62.7	24.6	38.1	115.5	162.3	94.6	559	44.0	1.55
» + sod. chloride	63.7	27.0	36.7	118.1	182.9	89.3	469	57.6	1.36
Ammon. sulphate . .	51.8	18.7	33.1	86.8	111.9	75.6	418	44.6	1.77
» + sod. chloride	61.4	24.5	36.9	112.1	161.5	90.1	546	44.9	1.50

The beneficial action of sodium chloride cannot be attributed to the action of sodium replacing potassium, for a potash dressing was added in each case. The writer points out further that sodium chloride increased the yield when given with nitrate of soda and sulphate of ammonia, yet failed to do so when given with ammonium chloride, so that it would appear that the fertilising action of the sodium chloride were not due to its sodium content, but rather to its chlorine content, the soil used in the experiment only containing 0.0016 per cent. of the latter element.

In field experiments a dressing of sodium chloride has usually increased the yield both when nitrogen was supplied in the form of a fertilizer containing sodium (nitrate of soda), or of one containing no sodium (calcium cyanamide), and in several cases an increase was observed when the sodium chloride was applied in addition to 180 lbs per acre of 37 per cent. potash salts. In other cases identical results were obtained with a potash dressing and when sodium chloride replaced a corresponding amount of kainit in the dressing.

Sodium chloride affected the various crops rather differently: with roots crops in nine cases out of ten, 430 lbs. of sodium chloride per acre gave better results than 180 lbs. of 37 per cent. potash salts, and similar yields were obtained with 430 lbs. of sodium chloride and 530 lbs. of kainit per acre; with oats and hay application of sodium chloride also proved beneficial though less effectual than an equal dressing of 37 per cent. potash salts. The writer concludes that applications of sodium chloride might frequently replace potash dressings with advantage, especially in the case of root crops (and mangolds in particular), and that the beneficial effect of the sodium chloride is due to its chlorine content or to some other factor, but not to its sodium content. Further, he considers that the beneficial effect of potash applications are not always due to the fact that potash is a plant food, but may be due in part to a factor analogous to the one reacting in the case of sodium chloride.

418 - **Mixed Dressings of Cyanamide and Superphosphate.** — KOPPEN, H. in *Illustrierte Landwirtschaftliche Zeitung*, N. 18, pp. 181-182. Berlin, March 1914.

The writer has carried out some experiments with the object of ascertaining the advisability of mixtures of cyanamide and superphosphate. Considering it from a purely theoretical point of view it might be expected that, both bodies being very susceptible to chemical reactions, changes might take place in their chemical compositions.

With regard to the nitrogen, the experiments have demonstrated that mixing the two fertilizers does not decrease the active form of this element. With the phosphoric acid however, the case is different, for it has been found that in the mixture of the two artificials, the total amount of water soluble phosphoric acid of the superphosphate retrogrades to the citric acid soluble form, which means a notable decrease of the value of the superphosphate. The phosphoric acid is thus deprived of its most valuable property, namely that of distributing itself over a large area, and by the use of such a mixture no better distribution of phosphoric acid in the soil is obtained than by the use of basic slag.

For this reason the writer considers that the preparations and use of cyanamide superphosphate mixture is not advisable.

419 - **The Composition and Agricultural Value of Carbonate of Lime from Causticising Plant.** — HENDRICK, J. (Marischal College, Aberdeen) in *Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 3. London, February 16, 1914.

In the 58 paper mills situated in Scotland, it is estimated that approximately 20 000 tons of waste lime (expressed as dry material) are produced annually from causticising plant. This material has to be disposed of, and the paper works have in many cases offered it gratis to farmers, but the latter have not availed themselves of the opportunity, for in the first place they found the substance difficult to handle in its wet, pasty condition, and secondly, they were sceptical as to benefits derived from its application. Its use in the undried state is quite possible if farmers will merely cart it on to the land and leave it in heaps to drain and to be subjected to the action of frost, after which it will be spread quite easily; but it can also be dried artificially, and some paper works have already erected the necessary plant for the purpose, and are selling the product to farmers at prices sufficient to cover the costs of drying and marketing. Drying reduced the water content from an average of about 45 per cent. to about 10 per cent. or under. The dried material chiefly consists of carbonate of lime, and may also contain a small quantity of free caustic soda. On the whole the dried samples contain as much "available lime" (*i. e.* available to neutralise acids) in the form of carbonate of lime and hydrate of lime as is contained in ordinary commercial ground limestone, and they contain more than half as much available lime as is contained in ordinary commercial burnt lime.

Some preliminary field trials have been carried out by the writer on the manurial value of waste carbonate of lime applied at the rate of four tons per acre to turnip crops on land known to be infested with finger and toe disease. Simultaneous applications of quicklime (1 and 2 tons per acre) and of gas lime (2 and 4 tons per acre) were also made. In almost every case the application of any form of lime has had a distinctly beneficial effect on the crop, the waste lime and quicklime being specially successful in reducing disease, and, of the three forms of lime, the waste lime has always proved quite as, if not more, effectual than the other two in increasing the crop.

The experiments are being continued.

420 - **A New Manure: Electro-potash ("Electro-Kali").** — SÖDERBAUM, H. G. in *Kunstl. Landbruks-Akademiens Handlingar och Tidskrift*, Year 53, No. 1, pp. 15-32. Stockholm, 1914.

The price of German potassic salts is much higher in Sweden than in other countries, and the writer reviews all the trials which have been made to utilize felspars, or other potassic rock constituents in Sweden, for the preparation of potassic fertilizers.

Up to the present all attempts have failed, but a new method recently invented by two Swedish workers, A. LINDBLAD and L. YNGSTRÖM appears promising. The raw material is a common rock in Central Sweden called *lep-*

tite or *eurite* similar in chemical composition to a gneiss or felspar, and may contain up to 11 per cent. of potash. Leptite is mixed with coal and iron filings, and treated in an electric oven provided with carbon electrodes at a temperature of 1800° C. approx. At this temperature the silicic acid in the rock is partially reduced to silicon; this combines with iron to form a silicic iron which collects in the bottom of the oven under a layer of slag consisting chiefly of potassium and aluminium silicate and more soluble than the silicates in the original leptite. The slag, when cold and finely ground forms a grey powder and is sold under the name of electro-potash ("electrokali").

The principal product, silicic iron, is easily disposed of as an alloy for various metallurgical uses, but in order that the manufacture should prove remunerative, a market must also be found for the electro-potash. The latter was analysed at the Central State Experimental Station and was shown to contain about 11 per cent. of potash, of which 10 per cent. is soluble when the material is treated on the water bath with 20 per cent. hydrochloric acid, while shaking the material with 2 per cent. hydrochloric acid for twelve or twenty four hours dissolved out 6 and 6.5 per cent. respectively.

The writer carried out some pot cultures in which the new manure was tested against sulphate of potash, both being supplied at the rate of 180 lbs of potash per acre. The results show that the electro-potash pots yielded 78 per cent. of the crops obtained on the sulphate of potash pots which is fairly satisfactory as a first experiment. Moreover as it was found possible to increase the solubility of the slag during the year 1913, it does not seem improbable that further trials will yield still better results, so that this new method of using native resources for fertilizing the soil may prove an economic possibility.

421 - **Experiments on the Selection of Spring Wheats from Autumn Wheat in Hungary** (1). — GRABNER EMILE in *Köstelek*, Years 21, No. 16, pp. 474-475. Budapest, February 21, 1914.

PLANT
BREEDING.

The varieties of spring wheat at present cultivated in Hungary are not in great favour as the more productive types are late in maturing and produce grain of inferior quality, and the earlier types give low yields. They are only grown on a large scale when the weather conditions in the autumn are unfavourable to the sowing of autumn wheats. The writer proposes to meet the situation by improving the ordinary spring wheats and by the selection of several types of autumn wheat suitable for spring sowing. He gives the result of the first season's work in this direction carried out by the Royal Hungarian Institute for Plant Breeding in co-operation with several plant breeders, during which, a large number of native and foreign varieties were tried. Some of these varieties continued to tiller till August, others, though late, produced stems and ears and others again produced grains.

(1) See also: Nos. 325, 326, *B.* February 1912. — No. 651, *B.* April 1912. — No. 353, *B.* April 1913. — Nos. 223, 224, *B.* March 1914.

422 - **Hybrids between *Triticum monococcum* and other Species of Wheat.**—

BLARINGHEM, M. in the *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 5, pp. 346-349, + 1 Fig. Paris, February 1914.

Various workers have tried to obtain fertile hybrids between *Triticum monococcum* and other species of wheat but without success. This has led to the belief that *T. monococcum* was of different botanical origin and formed a distinct class of its own. The writer has made several attempts to obtain hybrids of *T. monococcum* and was successful only with the pollen of *T. durum* and *T. polonicum*, which belong to a different group of wheats. No success was obtained when *T. monococcum* was used as the male parent. The differences in the degree of fertility and the uncertainty of the results among the different strains of each species point to the existence of an individual sexual affinity between the different strains of the parental species.

The three hybrid seeds obtained by crossing *T. monococcum* and *T. durum* var. *macaroni* gave rise to three vigorous plants, one of which was sterile and grew to a height of 6 ft. The other two produced seed which produced more fertile plants without segregation of characters. By analogy with *Aegilops speltæ formis*, Jordan, the writer has named this new species *Triticum dicoccoforme*. The hybrids between *T. monococcum* and *T. polonicum* var. *compactum*, showed the dominance of the starchy albumen and the round and finely wrinkled surface characteristic of the latter parent.

423 - **The Inheritance of Quantitative Characters in Maize (1).**—EMERSON R. A. and EAST E. M. in the *Agricultural Experiment Station of Nebraska, Research Bulletin* No. 22, pp. 120, + Figs 21. Lincoln, Nebraska, April 1913.

The theory of inheritance by multiple factors has been applied by the writers in the study of the inheritance of quantitative characters in maize.

The experiments were begun in 1906 and have been conducted at the Connecticut Agricultural Experiment Station at New Haven, at the Bussey Institution of Harvard University, and at the Nebraska Agricultural Experiment Station at Lincoln. The characters studied in these experiments were:

1) number of rows per ear, 2) length of ear, 3) diameter of ear, 4) weight of seeds, 5) breadth of seeds, 6) height of plants, 7) number of nodes, 8) length of internode, 9) number of stalks per plant and 10) earliness of maturity.

Some of these characters, especially length of ear, weight of seeds and height of stem, are affected by environment and the stimulus to development due to heterozygosity. Thus it becomes difficult to determine to what class a particular individual really belongs. Gametic impurity of the parents is also a source of error and it is extremely difficult to obtain parents of the simple type, ($x + aa\ bb\ cc$) and ($x + AA\ BB\ CC$).

The degree of heterozygosity of the parents is always indicated by excessive variation in F_1 , thus apparently diminishing the range of variation due to segregation and recombination of factors in F_2 . Crosses which produce

(1) See also original article p. 861. B. June 1913.

excessive variation in F_1 are therefore neglected. Again, the variation in F_2 may exceed that in F_1 in a degree unsuspected by the difference in size of the parents. For example a cross between parents of the type AA BB CC and DD EE FF (1) would give rise in F_2 and F_3 generations to progeny of the types *aa bb cc dd ee ff* and AA BB CC DD EE FF and this is what would have occurred if these had been the original parents types.

Summary of the results of the experiments :

1) *Number of rows per ear.* — Eight crosses between 8-rowed, 12-rowed, 16-rowed and 20-rowed types were studied. In nearly every case the F_1 generation was intermediate between the parents, and in most cases the F_2 generation had a wider range than F_1 and included both parent types. Where F_3 families were grown the parent types were recovered in every case.

The results of a cross between Tom Thumb Pop and Missouri Dent are given in Table I :

TABLE I.

Number	Year	Generation	No. of rows of parents	Classes for number of rows per ear												Mean
				8	10	12	14	16	18	20	22	24	26	28		
Missouri Dent.	—	P	—	—	—	1	1	7	9	6	1	—	—	—	17.7 (2)	
Tom Thumb Pop.	—	P	—	—	2	15	3	—	—	—	—	—	—	—	11.4 (2)	
F ₁ Generation.	—	F ₁	—	—	—	—	—	2	2	1	—	—	—	—	(2)	
1127	1911	F ₂	—	—	1	13	26	15	6	2	—	—	—	—	14.57 ± 0.18	
1142	1911	F ₂	12	1	7	46	17	3	—	—	—	—	—	—	12.38 ± 0.11	
1144	1911	F ₂	14	—	1	15	29	33	3	—	—	—	—	—	14.54 ± 0.13	
1140	1911	F ₂	20	—	—	—	—	1	10	31	20	9	3	1	21.04 ± 0.17	

2. *Length of ears.* — The inheritance of this character was studied in three crosses. In one case the F_1 generation had ears as long as those of the long-eared parent, doubtless due to the heterozygosity of one of the parents, for the means of the F_2 families were distinctly intermediate between the parental means. In most cases the progeny of the F_2 generations completely bridged the gap between the parents.

3. *Diameter of ears.* — This character was studied in two crosses. The F_1 generation was intermediate in diameter between those of the parents, but somewhat nearer the large-eared than the small-eared variety. The parent types were not recovered in F_2 , but the several F_2 lots were very distinct.

4. *Weight of seeds.* — Only one cross was studied for this character. The distinct types of seed-weight were isolated in F_2 , though neither parent

(1) The real gametic composition of these parents would appear to be AA BB CC *dd ee ff* and *aa bb cc*. DD EE FF respectively. (Ed.).

type was recovered. The great variability of several F_2 lots indicated sufficient heterozygosity to enable the isolation of parent types on further selection.

5. *Breadth of seeds.* — Two crosses were studied for this character, and in both cases the F_1 generation was distinctly intermediate in character between the parents. Practically all the classes from below the mean of the small seeded parent to above the mean of the large seeded parent were obtained in the F_2 generation. Two of the F_2 lots of the cross between Missouri Dent and Tom Thumb Pop, grown from small-seeded individuals had seeds practically as small as those of the small seeded parent. Since the total number of F_2 plants was slightly over 300 in each cross, it is thought that Missouri Dent and Tom Thumb Pop probably differed by five or less factors.

6. *Height of Plants* — This character was studied in 4 different crosses. In three of them the F_1 plants were almost as tall as the tall parent and in the fourth they were considerably taller than the mean of the two parents. That this increase in height of the F_1 plants is due to heterozygosity is shown by the fact that in every case the mean height of the F_2 plants is about half way between the heights of the parents, and by the lack of skewness in the F_2 frequency distributions. Few F_2 families were as tall as the tall parent and none was quite as short as the short parent. In some of the extreme F_2 lots, the variability was sufficient to make it probable that types like the parents could be isolated in the next generation,

The results obtained in the cross between Tom Thumb Pop and Missouri Dent are given in Table II :

In some of these crosses the character for height was separated into its components—number of nodes and length of internode. The inheritance of number of nodes was exactly what would be expected according to the theory of multiple factors, *i. e.* the F_1 generation was intermediate in character, the F_2 showed wide range of variation and the F_2 families included types resembling the parents.

7. *Length of internode.* — This character was so much affected by heterozygosis that in some cases the F_1 generation had longer internodes than the long-internode parent. One of the F_2 families had a range of variation extending from considerably below the minus extreme of the short-internode parent to much above the plus extreme of the long-internode parent, and considerably above the plus extreme of the heterozygous F_1 . This extreme range therefore indicated impurity of the parents and new combinations of factors in F_2 .

8. *Number of tillers.* — The F_1 generation was intermediate in number of stalks per plant and F_2 showed great variation. The F_2 families contained some one-stalked types and others with a somewhat larger mean number of stalks than the tillering parent and a range of variation so great as to suggest the possibility of isolating types with a still larger number of stalks. In one of the crosses the few-stalked parent was taller than the many stalked parent. With respect to total length of stalk the parents were almost equal, but the total length of stalk of F_1 almost equalled the combined

TABLE II.

No.	Year	Gen.	Class centres in decimetres for height of plants																							Coef. of var.	
			6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		
146	1909	P																									
151	1909	P																									
170	1909	F ₁																									
509	1910	F ₁																									
1128	1911	F ₂																									
1132	1911	F ₂																									
1141	1911	F ₂																									
1149	1911	F ₂																									

(1) Variation indicated by arrows.

stalk length of both parents, and that of the F_2 generation was considerably greater than that of either parent, while some of the F_3 lots had a mean total length of stalk twice as great as that of the long stalked parent. This increased stalk length shows a lack of correlation, either physiological or gametic, between number of stalks and height of plant, and is probably due to a combination of the factors influencing total stalk length, some of which come from one parent and some from the other.

9. *Earliness*. — The F_1 plants were intermediate between their parents. The F_2 generation included all types between the parents and distinct types were obtained in the F_3 some of which were practically as early as the early parent.

CONCLUSION.

Thus the inheritance of the above characters in maize is what would be expected if the quantitative differences were due to numerous factors inherited in a strictly Mendelian manner. The interpretation of the results is sometimes made difficult by gametic and physiological correlations, but this does not counteract the effect of segregation of factors.

APPLICATION OF THE THEORY IN PLANT BREEDING.

The principal use of hybridisation in plant breeding is to secure new combinations of the characters present in the parents with a view to selecting and preserving the desirable ones. The number of factors by which distinct commercial sorts of crop plants are differentiated is sometimes very large. For example, suppose it is desired to produce a better silage corn by combining the length of stalk of the few-stalked dent varieties with the number of stalks of the short many-stalked flint varieties. Suppose that these varieties differ by 5 Mendelian factors influencing height of plant and by 5 factors affecting number of stalks. An F_2 generation of about 1000 plants, *i. e.* about one tenth acre plot, would be required to give an even chance of recovering a many-stalked type like one parent or a tall-stalked type like the other parent. Perhaps 3 or 4 times this number should grown to be at all sure of recovering the parent types. But with this number of plants there could be no hope that any of the very tall parents would also have very many stalks. With parents differing by 10 factors (5 for height and 5 for number of stalks), over one million F_2 plants or over 100 acres, would be required for an even chance of getting the desired combination of characters, and at least 2 or 3 times this number should be grown to make sure of the results. This method is obviously impossible under ordinary conditions. The desired combination of characters can however be obtained from a smaller number of plants by taking more generations. As many F_2 plants as practicable should be grown and selection made of such plants as combine most nearly the desired number of stalks and height of plants. By continuing this selection through succeeding generations the desired result will be obtained.

When dealing with plants like corn that are much more vigorous when many characters are heterozygous, the breeder will find it necessary to practise cross breeding between different isolated types. He should therefore isolate several types possessing the particular character desired but which differ by sufficient minor characters, quantitative or qualitative, to insure a vigorous development on crossing. The breeder who selects for, say, high-oil content, from open pollinated plants will, if he persists long enough, succeed in producing a type with enough factors for oil production to rank as a high-oil type and with these factors sufficiently homozygous to insure comparative constancy, and at the same time with a sufficient number of minor factors heterozygous, to insure a comparatively vigorous strain. But by self pollination and selection, several practically homozygous high oil strains could have been secured in much less time, and these would have been sufficiently unlike in other less important factors to ensure a vigorous heterozygote on crossing. In breeding work requiring costly chemical analysis, obtaining results in as few years and with as few analyses as possible is an important consideration.

424 - Determination of the Varieties of *Triticum monococcum* L. — FLAK-SPERGER, C. in *Bulletin für angewandte Botanik*, Year 6, No. 10, pp. 689-695. (German abstract) + 8 Fig. St. Petersburg, October 1913.

CEREAL AND
PULSE CROPS

As the result of a series of experiments on *Triticum monococcum*, the writer gives the following characters for the determination of varieties.

A. — Joints of the rachis covered with dense white hairs. Base of spikelet covered with dense bristles. Wild types of *T. monococcum* (Group *aegilopioides* Asch. and Gr.).

I. Ears yellow or light brown, empty glumes with narrow triangular notches, alternately 2 1/2 mm. and 1 1/2 mm. long. Flowering glumes with long awns. Awns of almost equal length or one half shorter than another. Var. *Thaoudar* Reut., pr. sp.

II. Empty glumes erect, with triangular notches alternately 1 1/2 mm. and 1/2 mm. long. Awn of the sterile flower very short and often limited to a sharp point:

1. Empty glumes glabrous.

(a) Ear yellow, var. *Boeoticum* Boiss, pr. sp.

(b) Ear red, awns black, var. *Larionowi* m.

(c) Ear black, var. *Pancici* m.

2. Empty glumes velvety.

B. — Internodes of the rachis glabrous. Base of the spikelet glabrous or only slightly hairy. Cultivated varieties of *T. monococcum* (group *cereale* Asch. and Gr.).

I. Empty glumes incompletely covered with hairs, slightly wrinkled in the upper part of the keel. Ear red, not shiny, var. *Hornemannii* Clem.

II. Empty glumes glabrous:

1. Spikelets quite yellow, not shin. Empty glumes slightly wrinkled at the keel; var. *laetissimum* Körn.

2. Ear red or light red.

(a) Ear dull, empty glumes slightly wrinkled at the upper part of the keel without ridges or only slightly marked; var. *flavesccns* Kon.

(b) Ear shiny, empty glumes glossy at the keel, or slightly wrinkled at the upper part, or strongly ridged; var. *vulgare* Körn.

425 - **Hungarian Experiments on the Cultivation of an Early Variety of Maize with Soft Grains, 1912-13.** — SURÁNGI JÁNOS in *Köztelek*, Year 24, No. 16, pp. 473-474. Budapest, February 21, 1914.

In Hungary, except for certain elevated regions, early varieties of maize giving low yields are not grown to any considerable extent, the later and more productive varieties being preferred. The better known early varieties still cultivated are the "cinquantino", the "pignoletto" and the "Alcsuth", a new type obtained from the latter by selection. Their cultivation however has become difficult even in the districts in which the early varieties are more suitable, partly because their cultural requirements entail more manual labour and partly because their hard grains are not suitable for feeding to stock. As a result of this the Royal Agricultural Experiment Station at Magyaróvár has undertaken experiments with the most varied types of maize.

In the course of these experiments a variety known as "Moldova" with soft yellow grains, received from Baron Jean Kapri, agriculturist of Banest (Roumania), attracted attention by its rapid development which appeared to exceed that of the earliest variety under experiment. "Moldova" is a local variety not yet subjected to selection and leaving much to be desired regarding its grain, rachis, and shape of ear which averages from 12 to 16 rows of seed. Nevertheless, on account of its remarkable earliness, the station has carried out experiments to determine its cultural value under the various soil, climatic and economic conditions in Hungary.

During the seasons 1912-1913, 59 domains in the most varied regions of the country took part in the trials, "Alcsuth" being used as the standard of comparison. "Moldova" proved earlier than "Alcsuth" but a lighter yielder, and requires considerable improvement in respect of various characters before being adopted in practice.

426 - **Researches on the "Topping" and "Stripping" of Maize in Italy.** — MANARESI, A. and BERNARDI, G. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part I, pp. 33-40. Modane 1914.

These investigations deal with the influence of the time of topping and stripping maize plants on the characters and chemical composition of the grains. The results are summarised in the adjoining table:

It will be seen that the weight of 100 grains, the weight per bushel and the density increase as the plant becomes more mature, *i. e.* as the topping and stripping are delayed or not carried out at all. The germinating power, on the contrary, does not increase to any considerable extent, and the same may be said of the percentages of ash and phosphoric acid. The humidity remains almost constant at about 10 per cent., and was only determined to account for certain variations in the density. With regard to total nitrogen, CONTI found that the percentage was greater at

No. of row	Date of topping and stripping	No. ears analysed	Total weight			Mean weight		Weight of		Germinating power	Density	Humidity	Raw ash	Phosphoric acid in		Total nitrogen
			ears	grains	lbs	of one ear	lbs	100 grains	1 bushel					dry matter	ash	
			lbs	lbs				gms.	lbs	%		%	%	%	%	%
I A	Stripped 25 July 1912	50	9.92	7.63	0.20	0.15		17.48	57.25	94.6	1.130	10.267	1.578	0.837	52.92	1.91
B	" 1 August "	"	13.67	10.49	0.27	0.21		20.03	58.45	95.7	1.219	10.744	1.604	0.751	46.784	1.86
C	" 7 " "	"	17.86	14.04	0.36	0.28		23.60	60.69	97.1	1.236	10.077	1.501	0.753	49.597	1.86
D	" 16 " "	"	23.37	18.43	0.47	0.37		30.81	61.33	95.6	1.254	9.751	1.460	0.777	53.216	1.99
E	" 21 " "	"	23.81	17.81	0.48	0.36		31.12	61.57	96.1	1.260	9.542	1.450	0.696	48.340	1.83
F	Not stripped	"	24.03	17.59	0.48	0.35		31.68	61.33	96.6	1.257	9.974	1.540	0.750	48.797	1.89
G	" "	"	24.25	17.84	0.49	0.36		32.05	61.25	97.8	1.249	10.237	1.493	0.774	57.889	1.80
II A	Topped 8 August 1912	76.5	30.49	26.39	0.40	0.32		33.67	60.45	96.1	1.247	10.460	1.343	0.684	50.913	1.70
B	Stripped 22 " "	"														
"	Topped " " "	45	16.14	12.52	0.36	0.28		32.85	60.53	96.6	1.256	10.690	1.298	0.665	57.368	1.68
"	Stripped " " "	"														
C	Topped " " "	41	17.55	13.23	0.43	0.32		32.72	60.45	93.8	1.250	10.940	1.475	0.728	48.408	1.63
D	Normal " " "	56.5	25.11	18.81	0.44	0.33		34.89	60.53	95.3	1.249	10.860	1.307	0.690	52.798	1.72
III A	Topped 19 Aug. 1913	49	21.56	17.97	0.44	0.37		34.35	60.05	—	—	—	1.571	—	—	1.47
"	Stripped 27 " "	"														
B	Normal " " "	50	23.90	19.40	0.48	0.39		35.47	60.21	—	—	—	1.604	—	—	1.58
IV A	Topped 18 Aug. 1913	45	20.55	16.69	0.46	0.37		34.66	59.97	—	—	—	1.418	—	—	1.48
"	Stripped 22 " "	"														
B	Topped 18 " " "	80	24.05	19.40	0.50	0.40		36.33	61.25	—	—	—	1.455	—	—	1.50
V A	Topped 23 " " "	—	—	—	—	—		36.95	59.01	—	—	—	1.795	—	—	1.48
"	Stripped 26 " "	"														
B	Normal " " "	—	—	—	—	—		37.98	59.49	—	—	—	1.625	—	—	1.61

the commencement of the formation of the grain, while these results show an almost constant figure throughout the samples.

The effect of seasonal variations on the grain is shown in the results of series II, III, IV, obtained from crops grown in the same district with the same manurial and cultural conditions, but in different years. Series II are the results of the very dry summer of 1912 while those of II and IV were obtained during the very rainy season of 1913. The grains of the two latter series are not only heavier but larger, richer in ash and poorer in nitrogen.

- 427 - **Loss in Weight of the Ears of Maize on Drying. Hungarian Experiments.** — ZSIKMOND KISZEL in *Közeleik*, Year 24, No. 16, pp. 472-473. Budapest, February 21, 1914.

Experiments were carried out to estimate the loss of weight undergone by maize during the drying process. This was found to be a very variable quantity being influenced by the variety of the maize, by the kind of drying shed used and by the meteorological conditions.

- 428 - **The Classification of the Bacteria of Leguminous Plants.** — KLIMMER M. and KRÜGER R. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Abt. II, Vol. 40, Nos. 11-13, pp. 256-265. Jena, March 1914.

The writers have cultivated *Bacillus radicicola* from 18 species of leguminous plants in serum cultures, and, from observations of the agglutination, complementary formation ("Komplementbindung") and precipitation, effects they divide them into nine distinct groups or species:

The first group includes the bacteria from *Lupinus perennis* L., *L. luteus*, *L. angustifolius*, and *Ornithopus sativus*; the second group the organisms of *Melilotus albus*, *Medicago lupulina*, *M. sativa* and *Trigonella foenum graecum*; the third those of *Lotus uliginosus*, *Anthyllis vulneraria* and *Tetragonolobus purpurea*; the fourth those of *Vicia sativa* and *Pisum arvense*.

The organisms of *Vicia Faba*, *Trifolium pratense*, *Phaseolus vulgaris*, *Soja hispida* and *Onobrychis sativa* constitute distinct species.

ROOT CROPS.

- 429 - **Selected Strains of Hungarian Potatoes, and their Productivity.** — GRABNER EMIL in *Közeleik*, Year 24, No. 13, pp. 553-556. Budapest, February, 13, 1914.

The Royal Hungarian Institute of Plant Breeding at Magyaróvár conducts field trials from year to year with foreign varieties of potatoes in competition with strains of local varieties selected at the Institute. The results obtained in 1913 show that the Hungarian variety "Margonyai" is the most productive. The highest yields were obtained from "Margonyai VII, III and V", which gave from 42 800 to 55 200 lbs per acre in good soil. These figures were only reached by two other foreign varieties, viz. "Svites" and "Kürger" which yielded from 48 100 to 49 800 lbs per acre and 53 500 to 55 200 lbs. per acre respectively.

In respect to quantity of starch the variety "Margonyai X" was equal to the best foreign varieties (19.51 to 22 per cent.).

430 — **Manurial Experiments with Potatoes in Hungary, 1913.** — RÁSZ, A. in *Köztelék*, Year 24, No. 22, pp. 719-720. Budapest, March 14, 1914.

An account is given of fertilizer trials with potatoes carried out by the National Agricultural Society of Hungary during the season 1913.

431 — **The Duration of a Lucerne Ley.** — VIVENZA, A. in *Le Stazioni sperimentali Agrarie Italiane*, Vol. XLVII, Part. 2, pp. 97-118 + Plates I-VIII. Modane, 1914.

FORAGE CROPS.
MEADOWS
AND PASTURES.

These experiments on the cultivation of lucerne were conducted at the Experiment Station of the Higher Institute of Agriculture at Pérouse during 1902 to 1912.

The observations and conclusions relate chiefly to the production of forage in relation to the age of the plants and to the rainfall, and also to the formation of turf (stems and roots) in relation to the age and growth of the plants; they cover the whole period from the time of sowing until the clearing of the crop owing to degeneration.

1. The duration of lucerne cannot be definitely determined without taking into account the soil conditions and varieties of the plant. It may vary from a few years to several decades. Under normally good cultivation, the maximum duration is from 15 to 16 years.

2. Under normally good culture conditions the seedlings come up very thickly, and suffer considerable mortality during the first year; in the second year the mortality diminishes and ultimately falls to a constant rate of about 10 per cent. per year.

3. The yield of lucerne under field conditions reaches a normal level after the first year; during the two following years it remains constant or increases slightly, then slowly decreases. These variations are quite distinct from those due to meteorological changes from year to year.

4. The quantity of accumulated vegetable matter (stalk and roots) increases until the 5th year (*i.e.* the 4th year of production). In this particular experiment the quantity of vegetable matter was found equal to 21 960 lbs per acre corresponding to 7 920 lbs per acre of dry matter containing 186 lbs of nitrogen. After the 6th year the quantity of residue per unit area decreases, but at a slower rate than the decrease in yield, and independently of any climatic variations.

5. Abundant rainfall increases the yield of lucerne to a considerable extent, the yield being directly proportional to the rainfall during the months of April, May and June.

6. Each particular plant gives its maximum yield under field conditions during the first three years, after which it diminishes but not regularly. The plants may even increase in weight with age owing to the ramification of the stalks and the thickening of the roots. Occasionally the trailing stalks of old plants develop secondary roots.

432 — **The Kudzu Vine (*Pueraria Thunbergiana*), a New Forage Plant in Florida.** — EPPES, E. B. and PLEAS, C. E. in the *Florida Quarterly Bulletin of the Agricultural Department*, Vol. 23, No. 3, pp. 89-101, + 1. Plate. Tallahassee, Florida, July 1913.

This new forage plan shows promise of superseding the velvet bean and of becoming the most important crop in the Southern States. It is

a deep-rooting trailing perennial and seldom produces seeds. It is propagated by means of plant roots set in rows 8 1/2 feet apart each way.

The yield of hay increases as the plant becomes established, from 3 tons in the second year to 6 and even 10 tons per acre on good land. It dries rapidly requiring only 24 to 28 hours, does not shed its leaves and does not appear to be damaged by rain.

Chemical analysis shows that it contains 17.4 per cent. protein and 30.20 per cent. carbohydrate (starch and sugar). Owing to its low percentage of carbohydrate it should be fed with Japanese sugarcane either as silage or chopped into short lengths. It possesses the advantage of being easily eradicated, when necessary, by close grazing in the spring or by breaking up the crowns with a disc plow after cutting in the dry season or during frost in the autumn. When fed to stock it has no tendency to cause intestinal disorders. Moistened with water it makes an excellent green ration for poultry in winter.

433 — **A New Forage Plant, (*Lolium multiflorum*).** — DENAÏFFE, M. and COLLE, J. in the *Journal d'Agriculture Pratique*. Vol. I, (New Series), No. 10, pp. 300-302. Paris, March 1914.

Lolium multiflorum is recommended as an excellent catch crop either alone or in combination with *Trifolium incarnatum*. Morphologically it resembles a hybrid between *L. perenne* and *L. italicum*. It grows to a height of 60 cm. to 1 metre and has the general habit of growth of Italian rye grass. Sown on land in "good heat" it produces a crop ready for cutting in from 8 to 10 weeks.

Comparative trials with the three varieties of rye grass on a siliceous clay soil of average fertility gave the following results:

	Yield in lbs per acre		
	<i>L. multiflorum</i>	<i>L. italicum</i>	<i>L. perenne</i>
Green weight	10 697	11 783	12 210
Dry weight	4 343	2 748	2 748

The yield of *L. multiflorum* obtained at Carignan was much higher, viz. 21 449 lbs per acre of green weight containing 5 058.7 lbs of dry matter. The higher figures for the green weight of *L. italicum* and *L. perenne* obtained at Presle are attributed to the moist weather at harvest and the more tufted habit of these grasses which tends to prevent rapid drying.

A comparison of the chemical composition of these grasses is given in the adjoining table.

The superior feeding qualities of *L. multiflorum* are shown by the figures for cellulose, carbohydrates, and ash. With respect however, to the percentage of albuminoids and fats Italian rye grass is superior.

	<i>L. multiflorum</i>	<i>L. italicum</i>	<i>L. perenne</i>
<i>Organic constituents %:</i>			
Water	14.30	14.30	14.00
Albuminoids.	7.23	9.0	5.30
Amides	2.45	2.20	1.90
Fats	1.40	3.20	1.40
Cellulose	20.50	22.90	23.80
Carbohydrates	44.62	40.60	46.90
Ash	9.00	7.80	6.70
<i>Inorganic constituents %:</i>			
Nitrogen	1.54	1.80	1.10
Phosphoric acid	0.60	0.40	0.36
Potash	1.24	0.75	3.90
Lime	0.80	0.60	1.00

434 - **The Cultivation of Sugar Beets in the Island of S. Miguel in the Azores.** — Molz, E. in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, Nos. 31 and 23, pp. 257-258 and 288-289 + 8 figs. Berlin, March 1914.

SUGAR CROPS

The cultivation of sugar beets in the Azores is limited to the island of S. Miguel and has existed there only since 1906. The acreage under beets increased from 719 acres in 1908 to 2964 in 1912. The average crops in the above period was 9.75 tons per acre.

The land is in the possession of only a few owners who rent the land to farmers. The rents vary from £6 per acre in the neighbourhood of the capital to £2 per acre in the interior of the island. The whole crop is worked up by one factory which holds a monopoly from the Portuguese Government and is protected against foreign competition by a customs duty of about 4³/₄ per lb. of sugar.

For the raising of sugar beets the position is somewhat too far south, but this is compensated by its maritime climate. The porous, stony soil, in which deep ploughing is not often practised, suffers from drought, and without the high degree of atmospheric moisture the growing of beets would be quite impossible. The soil, a product of the weathering of trachytic lava, is poor in lime. Nitrogen and potash are also wanting. The factory has established special regulations as regards manuring, according to which farm yard manure, which elsewhere is considered the principal aid to beet root raising, is limited to a minimum. Green manuring is allowed. The farmers avail themselves of this concession and sow lupins in the autumn which are ploughed in the following March before the beets are sown. The method is not a good one and usually the beets suffer from chronic shortage of plant food.

The factory has also established regulations with regard to the rotation. The fields must be put to beets every third year. But sometimes only

one year's interval is allowed and occasionally the beets are sown year after year. Owing to the high rents the farmers try to get more out of the land by means of intercalary crops, and this again is unfavourable to the beet crop.

The harvest takes place during about the first half of August; it lasts a long time because the numerous fanged roots render cleaning operations more difficult.

Among the many pests to which the beets are subjected the following are especially to be mentioned: *Heterodera radicola*, *Heterodera Schachtii*, *Mamestra brassicae*, *Agrotis segetum*, *Blaniulus venustus*. The most dangerous pest of all is, however, *Thyphula betae* Rostr. a fungus which appears especially in dry positions and on flat soils and which damages the beets when they begin to ripen. A black dry rot and damping off fungus also occur.

VARIOUS CROPS

435 - **Bamboos in North Africa.** — RIVIÈRE CH. in *Journal d'Agriculture Tropicale*, Year 14, No 152, pp. 33-38. Paris, February 28, 1914.

The writer gives a study of the bamboos suitable for cultivation on a commercial scale in North Africa.

Group I: Rhizomatous bamboos. — These bamboos vegetate by means of runners in the spring. They never reach great dimensions but are widely distributed.

Three species of *Phyllostachys* are included:

1. *Phyllostachys mitis*, the largest species of the genus.
2. *Ph. viridi laeuscens* a species with numerous runners.
3. *Ph. aurea*, growing in tufts.

The compact stems and slow growing rhizomes gives these plants the appearance of a slightly raised hedge or wind break. The stems are straight, rigid and resistant and are suitable for wickerwork and trellises.

Of the *Arundinaceae*, *Arundinaria Simoni* is robust, produces copious runners and exceeds 6 feet in height. It shows great resistance on almost all soils, owing to its deep, powerful root system. Its stems are suitable for many purposes.

The above species are particularly suitable for fixing moving soils, dunes and exposed subsoil. Their propagation is simple and easy. Division of the rhizomes is carried out in the winter months and water is given 2 or 3 times in the spring.

Group II: Tufted bamboos. — Growth takes place during summer and autumn and the plants reach greater dimensions than the rhizomatous group. They are of limited distribution in N. Africa since they are very partial to the coastal climate. The most suitable locality is the sea shore adjoining fertile soil, not too compact and in good condition; also subject to watering in the summer.

Three species are cultivated at the present time:

1. *Bambusa macroculmis* (*B. arundinacea*), the largest species in N. Africa. It is ready for cutting after 3 years, and irrigation is absolutely necessary during the warm weather.
2. *Bambusa vulgaris*, smaller and less solid, but more resistant to cold than the preceding.

3. *Bambusa spinosa* (*B. glomerata*), has a wider area of cultivation. Its growth is so dense that it is used for making impenetrable fences, walls of defense, etc.

The writer mentions the precautions necessary when introducing a new species. The necessary watering should be attended to and particular care taken in packing. On arrival at its destination, each plant should be carefully placed in a nursery until a favourable time for transplanting, i. e. in mid-winter for the rhizomatous plants and at the beginning of spring for those of tufted habit.

436 — The Most Important Tannin Yielding Plants of German East Africa. — BODENSTAB HERMANN in *Der Tropenpflanzer*, Year 17, Nos. 9-12, pp. 463-481; 529-538; 619-631; 676-690 + 15 diagrams + 8 Figs. Berlin, September-December, 1913.

The writer points out the importance of the imports of tannin matter to Germany (about 300 000 tons valued at about £2 000 000) of which a considerable part comes from the tropics.

Mangroves (1). — The writer omits the mangroves of W. Africa and America and studies the four principal species of the Indian Ocean, viz., *Rhizophora mucronata* Lam., *Bruguiera gymnorrhiza* Lamb., *Ceriops Candolleana* Arn., and *Xylocarpus*. He points out the high value of mangroves for tanning purposes and shows by means of numerous graphs that the proportion of tannin yielded by these plants is approximately the same in all seasons of the year, at any time of the day, at different ages and from different parts of the plant.

The following table gives the percentages of tannin (by the official method) in different samples of bark, calculated on a basis of 14.5 per cent. humidity.

	Minimum	Maximum	Average
<i>Rhizophora</i>	—	—	—
<i>Bruguiera</i>	28	42	36
<i>Xylocarpus</i>	27	33	30
<i>Ceriops</i>	24	32	26

The writer has studied the influence of the time of harvest on the quality and in particular on the colour of the hide.

The bark of *Rhizophora* and *Bruguiera* gives as a rule a darker red colour to the hide than that of *Ceriops* and *Xylocarpus*; the latter imparts a yellow colour to the hide which darkens less on exposure to air. The bark of *Rhizophora* and *Bruguiera* harvested at the end of the year yields a lighter product, with a lighter red colour changing to a yellowish brown, instead of reddish brown, on exposure to light. If at all practicable, it would be better to collect the bark of these two species towards the end of the year only. The superior quality obtained at that season may be due to better desiccation. In any case the writer recommends that great care should be taken to obtain a well dried product by working rapidly and avoiding too high temperatures.

(1) See No. 379, B. April 1913.

(Ed.).

The leguminous trees, especially acacias, which produce tannin have also been studied by the writer.

Eucalyptus occidentalis Endl. (Malletrinde). — Occurs abundantly in Western Australia. The bark has been imported into Germany since 1905 and has rapidly conquered the market which now absorbs three quarters of the total production. The tree prefers a clay or sandy clay soil and a climate with a rainfall of from 12 to 20 in, of which 60 per cent. falls during the cold season, and extreme temperatures of 41° and 86° F with an average of 68° F. The commercial product consists of the inner bark containing from 35 to 52 per cent. and an average of 42 per cent. of tannin, the price of tannin being about 3d a lb. Tannin is soluble in water at ordinary temperature, forming highly concentrated solutions (up to a strength of 90 to 95 per cent.). The product contains only 7 per cent. of soluble non-tannin constituents, chiefly sugar. It produces hides of good quality and the tree is consequently recommended for planting in the German colonies.

Unripe fruits of *Terminalia Chebula* (Myrobalan chebule) contain 25 to 46 per cent. (mean 32 per cent.) of tannin, the shelled fruits from 45 to 55 per cent. It produces good hides and the writer considers the cultivation of the tree to be a commercial possibility.

437 — **The Cultivation and Commerce of Aniseed (*Illicium verum* Hook).** — CHEVALIER, A. in *Journal d'Agriculture tropicale*, Year 14, No. 152, pp. 40-44. Paris, February 28, 1914.

The cultivation of *Illicium verum* is restricted to countries having a very special climate as follows: a rainfall of about 60 inches distributed throughout the year, a sky very often overcast, a high degree of humidity and a temperature varying between 40° C. in summer and 0° C. in winter. The plant grows best in a red argillaceous schist on hill slopes. Planting is done on the quincunx system and the holes are dug 5 to 6 yards apart a considerable time before being required. Shade trees are necessary for the young plants and considerable attention is required until the 8th or 10th year with weeding, watering, hoeing and cutting. Fruiting does not begin until the 10th or even the 15th year and the tree reaches full bearing in about the 20th to 35th year. The yield varies considerably from one year to another and never exceeds 2 tons per acre of green fruit from a plantation in full bearing.

The green fruits are gathered before complete maturity, for the production of aniseed essence. In times of poor harvest the natives make use of the leaves which yield an essence similar to that of the fruits. The variation in the production of aniseed essence at Tonkin is shown by the following figures:

1902	58 tons
1904	32 tons
1911	100 tons
1912	46 tons

The yield was greater in 1913, the value exported being £100 000. It is exported chiefly to Marseilles, Havre and Hamburg.

The essence has been employed for a considerable time in the manufacture of liqueurs and has now found a substantial market amongst manufacturers of perfumery.

438 — **Promising Plant Immigrants in the Philippines.** — WESTER, P. J. in the *Philippine Agricultural Review*, Vol. VII, No. 2, pp. 77-81. Manila, P. I., February 1914.

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The following plants have been successfully introduced into the Philippines and are being distributed.

1. The Lyon Avocado. — Fruit of large size, average weight 800 gm. of which 86 per cent. is edible; oblong-oval in shape, with thick brittle skin of green colour, separating readily from the flesh; surface smooth with numerous irregular whitish lenticels; flesh pale, creamy yellow, tinged with green near the skin, with few fibres; flavour buttery and nutty; seed very small, oblong, nearly filling cavity, seed coat readily separating from the flesh; season, late July and early August. The tree is slow in coming to maturity but is able to ripen its fruit in the height of the rainy season.

2. The Cayenne Pine Apple. — Fruit of large size, average weight 3 to 2.75 kilos; shape oblong slightly conical truncate; colour brownish yellow; eyes, medium large, not prominent, of medium depth; flesh yellowish, very juicy, rich sweet and slightly acid somewhat fibrous and very aromatic; flavour and quality excellent; core rather large, inedible; crown comparatively small. This variety which probably originated in Cayenne French Guiana, is unexcelled for canning purposes and is extensively cultivated in Hawaii and Singapore.

3. The Queen Pine Apple. — Fruit small to medium weight, averaging from 1 to 1.5 kilos; form oblong, slightly tapering; colour straw yellow with brown markings; eyes rather prominent, small and deep; dorsal scale very long and spiny; flesh yellowish, tender, juicy, sweet, rich, somewhat less aromatic than Cayenne but sweeter; flavour and quality excellent; core comparatively small and fairly edible; crown small to medium. The plant is a strong and vigorous grower though dwarfer than Cayenne, and the fruit is somewhat affected by "eye-rot" when it ripens during the rainy season.

4. The India Cucumber. — The fruit is of large size, from 22 to 30 cm. long with an average circumference of 26 cm., and an average weight of 850 gm.; more or less triangulate in section; colour brown; surface fairly smooth, cracking on reaching maturity giving it the appearance of being reticulated; flesh less tender than the standard cucumbers of the temperate zone; seed abundant. The seed of this variety was obtained from Saharanpur, United Provinces, India. It has shown itself superior to all other cucurbits in resistance to insect pests which practically destroyed other varieties.

439 — **Blooming Periods and Yields of Fruit in Relation to Minimum Temperatures.**

— BALLANTYNE A. B. in *Utah Agricultural College Experiment Station Bulletin*, No. 128, pp. 245-261, + 8 Figs. Logan, Utah, November 1913.

Experiments have been conducted during several years with peaches, plums and cherries on an area liable to severe frosts. It was found that

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the amount of injury to the blossoms was not entirely dependent on the degree of frost, but that other factors such as humidity, rapidity of thawing after freezing, soil moisture and condition of the plant complicated the issue. During the first three years of blooming the damage by frost covers the whole of the crops, and in subsequent years it is sufficient to reduce the yield of most fruits and to entirely prevent some of them reaching maturity, especially almonds, nectarines and some apricots and peaches. Frosts of from 5° to 9° F. when the buds are moist, are less damaging than those of a similar or slightly greater severity when the buds are dry.

440 - **The Kumquat (*Citrus japonica*, Thunberg).** — DR. TRABUT in *Bulletin agricole de l'Algérie et de la Tunisie*, 20th year, No. 1, pp. 2-11. Algiers, January 1914.

The writer begins by an historical account of the introduction of this plant into N. Africa and America. The Kumquat is a small tree with the foliage of the mandarin, not exceeding 10 feet in height. It blossoms in late summer, producing axillary flowers. The fruits are roundish-oval in shape with a soft skin, sweet, aromatic, and of agreeable flavour. The pulp is slightly abundant and faintly acid. The seeds resemble those of the mandarin and the embryo is pistache-green in colour.

The writer describes three distinct varieties :

Razami, with a characteristic elongated fruit, grown as an ornamental plant.

Maroumi, small fruits, excellent for preserving, very fertile.

Omi Kin-Kan, large round fruits, excellent for preserving and desert.

Propagation. — *Citrus triptera* has been found to be the best stock for extensive culture in Algeria. Unlike other species of *Citrus*, it cannot be grafted at any season of the year, but only at the end of the growing season. Side grafting is very successful and crown grafting is also possible. The "Rough Lemon" or Florida Citrus is used as a stock in Florida.

The Kumquat may be planted 6 × 9 feet or even 6 × 6 ft., i. e. 1200 plants per acre. The tree responds readily to good treatment — generous manuring and a sufficient water supply increasing the number, size and quality of the fruits. *Citrus triptera* does not thrive as a stock in calcareous or slightly saline soils.

The Botanical Station has sent several harvests of this fruit to the principal confectioners who have offered to buy all that could be produced. The yield of a good plantation is considerable and regular. Six year old trees will yield from 2 to 6 lbs of fruit. Trees 10 feet high yield about 3 000 to 3500 fruits and at the low price of 5d per lb (1 fr. per kilo) one acre will return from £60 to £120.

441 - **Seedless Pomeloes in Siam.** — BOYLE H. H. in the *Philippine Agricultural Review*, Vol. III, No. 2, pp. 65-69, + 2 Plates. Manila, P. I. February 1914.

The writer visited a plantation of the famous seedless pomeloes in Siam and found that many of the so-called seedless varieties bore fruits with well developed seeds. More detailed examination of the trees and the precise position of the seeded fruits with respect to neighbouring trees of the "seed" variety showed that the "seedless" varieties are inter-sterile, and that they

only produce seeded fruits on the side nearest to a "seed" variety, the flowers of which are interfertile with those of the "seedless" variety. The Siamese attribute the seedless quality of the fruit to the presence of salt deposited by brackish water from the river in a dry season, and make a practice of placing a coconut shell of salt in each hole at the time of planting the trees.

442 - **The Chemical Composition of Florida Oranges.** — HENNY, A. M. in the *Annual Report of the State Chemist of Florida, 1913, Florida Quarterly Bulletin*, Vol. 24 No. 1, pp. 155-204. Tallahassee, Flo., January 1914.

In order to ensure uniformity in the enforcement of the Immature Citrus Fruit Law of 1911, numerous chemical analyses of Florida oranges have been made by standard methods. As a result of some 259 analyses the writer recommends that the mature fruit of *Citrus aurantium* L., the juice of which contains not more than 1.25 per cent. by weight of acid determined as crystallised citric acid be taken as the standard. Determinations of the sugar content do not appear to be necessary and are more difficult to carry out. Details are given of the methods of sampling and conducting the tests in the laboratory and in the field.

443 - **The Budding of Cacao.** — WESTER P. G. in *The Philippine Agricultural Review*, Vol. VII, No. 1, pp. 27-33. + 2 Plates. Manila, January 1914.

The writer gives an account of former experiments on the budding of *Cacao* and of the results obtained by Hart, Johnson, Harris and Jones. He emphasises the importance of the graft in determining a product of uniform quality. The operation is a simple process, easy and rapid of execution, and its success is almost assured if certain directions are followed.

The stock should be vigorous and at least 15 to 20 cm. in height. The failures of early experiments were due chiefly to the lack of care in the choice of the bud, which should be of the current or previous year's growth. All buds showing attached petioles or unhealed scars should be rejected.

All precautions usually prescribed in budding operations should observed in detail (such as cleanliness, condition of the grafting knife etc.).

The writer recommends the use of cotton bands and of a mixture of beeswax and resin. The cutting of the stock should be begun after about 15 days at a point 10 cm. above the graft. When the graft has grown to a length of 30 cm., the stock may be cut off completely, immediately above the graft. To prevent the attacks of insects and fungi, it is absolutely necessary to cover the wounds with a protective plaster.

444 - **New or Noteworthy Fruits.** — HEDRICK, U. P. in the *New York Agricultural Experiment Station Bulletin* No. 364, pp. 179-195, + 5 Plates. Geneva, N. Y., July 1913.

The writer gives a description with plates of varieties of apples, pears, plums, peaches, cherries, grapes, raspberries, currants, gooseberries and strawberries that have given good results during trials and appear to deserve the attention of fruit growers.

LIVE STOCK AND BREEDING.

HYGIENE

445 - Investigations into the Life History of the Warble Fly (*Hypoderma bovis*, Geer) and Means of Destroying it (1). — LUCET, ADRIEN in *Comptes Rendu. Hebdomadaire des Séances de l'Académie des Sciences*, Vol. 158, No. 11, pp. 812-814. Paris, March 16, 1914.

The writer reports upon his investigations into the life history of the warble fly (*Hypoderma bovis*) of cattle, conducted under the auspices of the French Ministry of Agriculture, and which may be summarized as follows:

1. The migration of the larvae takes place in May, June and July but mostly in the two first months and by preference in the early morning hours. Out of 79 larvae observed, 24 left the hide of the cattle between the 16th and the 24th of May, 53 between the 1st and the 30th of June and only 2 at the beginning of July. In the early part of July the cattle experimented with were always free from the larvae of warbles.

2. The breeding of larvae which have migrated from the hides can be easily carried out either on a protected plot of ground or in the laboratory. In 95 per cent. of the cases observed by the writer the larvae pupated. Every attempt at hastening the migration was always followed by injury during the subsequent development of the larvae.

3. The pupal stage is passed exclusively in the surface of the ground. All the larvae which the writer covered with earth on the advice of German investigators, invariably crept out again into the open before pupating.

4. The pupal stage lasts on average between 30 and 35 days. In 19 cases it lasted: once 29 days, twice 30 days, four times 31 days, four times 32 days, three times 33 days and once each 34, 36, 37, 38, and 40 days. These figures vary considerably from those of Gläser who found that the greatest range in 1912 was from 25 to 63 days and in 1913 from 37 to 56 days.

5. Out of 75 pupae, the writer bred 45 (60 per cent.) completely developed warble flies. Of these, the pupae kept in the open yielded 58 per cent. perfect flies; those maintained at room temperature yielded 50 per cent. when kept in a pot covered with grass and 89 per cent. when kept in a pot lined with wadding. Pupae in a pot lined with wadding and maintained at 25° C. yielded no perfect flies.

6. Warble flies are exposed to many enemies during the various stages of their development: rodents, birds, insects etc., and are frequently destroyed by lower fungi (*Cephalotecum roseum* etc.) the spores of which exist on the ground and penetrate through the chitinous walls of the pupa.

7. The hatching of the perfect fly only last a few minutes, and is not limited to the early morning but may take place any time during the day.

(1) See No. 144, B. Feb. 1913 and No. 251, B. March 1914.

446 - **Abortion in Sheep.** — *Journal of the Board of Agriculture*, Vol. XX, No. 10, pp. 879-883. London, January 1914. (Summary of the *III Report of the Departmental Committee on Epizootic Abortion* together with an *Appendix* to the same, Cd. 7156 and 7157. London, 1913).

The President of the Board of Agriculture and Fisheries appointed a Committee in April 1905, to inquire, by means of experimental investigation and otherwise, into the pathology and etiology of Epizootic Abortion, and to consider whether any, and if so, what, preventive and remedial measures might with advantage be adopted with respect to that disease.

In 1909 the Committee submitted a Report (Cd. 4742) embodying the principal results of their investigations concerning Epizootic Abortion as it occurs among bovine animals, and an Appendix by Sir J. McFadyean and Mr. (now Sir) Stewart Stockman, giving a detailed account of the experiments on which the Report was based.

The inquiry was extended to include a consideration of the administrative measures which should be taken to deal with cases of this disease in cattle, and a Report (Cd. 5279) was presented by the Committee in 1910 dealing with this aspect of the question.

A third Report has now been presented by the Committee, dealing entirely with abortion in sheep, and, in a separately published Appendix, an account is given of the experimental work on the disease in sheep carried out for the Committee by Sir J. McFadyean and Sir Stewart Stockman.

Microbe of Abortion in Sheep. — In the Committee's first Report it was stated that these investigators had never found the microbe of cattle abortion in connection with natural outbreaks of abortion among sheep, and that a totally different microbe — a vibrio — had been repeatedly isolated from outbreaks of abortion in ewes, and that it had been successfully used at the laboratory to infect pregnant ewes with abortion experimentally.

Although the Committee are not prepared to say that the vibrio is responsible for all serious outbreaks of abortion among ewes, they have not met with any other specific form of the disease in this species.

The microbe was found to occur both in the short "S" form as well as in various long spirillar forms. The individual organisms vary in length from 1.5 to 3 microns, and the breadth is from $\frac{1}{4}$ to $\frac{1}{3}$ of a micron at the middle part, which is broader than the extremities. The appearance of the spirillar forms is very like that of a spirochaete. The vibrio is motile.

Virulent Material and its Vehicles. — The contents of the infected uterus, viz. the exudate, the membranes and the foetus, contain the microbes and are virulent. An important point is that lambs may be born alive from an infected uterus at or about full time.

In the case of *bovine* abortion an infected cow is probably seldom in a position to infect others until the actual time, or shortly before the actual time of abortion, when virulent material is discharged from the uterus. This however, is not the case with *ovine* abortion. It would appear from the experiments carried out for the Committee that virulent material may be spread about the pastures (a) by infected ewes although they may lamb

at full time, (b) by aborting ewes, and (c) by infected ewes long before they show outward signs of being about to abort.

In connection with the dissemination of the disease among sheep, the Report calls attention to the fact that, as compared with epizootic abortion in cattle, ovine abortion is enzootic in character, that is to say, it seems to confine its operations to a comparatively small proportion of farms without showing much tendency to become widespread. On the other hand, it is pointed out that a disease does not owe its epizootiological character to its contagiousness alone, but also to the opportunities given it for dissemination. The opportunities which operate in relation to the disease in cattle and not in sheep are as follows: — (a) Breeding goes on all the year round in the case of cattle, whereas with sheep it is almost entirely confined to a season, and a considerable interval of rest intervenes. (b) Cows are frequently sent to the bull on other premises, where the disease may prevail, but this does not apply to ewes to any extent. (c) There is a very considerable interchange of in-calf and newly-calved cows through markets, while ewes are practically always tugged on the owners' premises and remain there throughout pregnancy.

The history of some flocks shows that the disease may prevail on the same premises at intervals over a number of years. It is difficult to explain how the virus is kept alive during the long interval between each breeding season; but bridging this interval it is comprehensible that in those outbreaks which have recurred after an interval of some few years, a few abortions not amounting to an outbreak, may have occurred in the intervening years. The circumstances surrounding some outbreaks favour the idea that the vibrio may lead a saprophytic or other existence outside the bodies of the sheep.

Methods of Infection. — The natural channels of infection are the alimentary and genital passages, mainly the former. The Committee considered whether any part in the spread of ovine abortion is attributable to the ram; and they state that it seems most improbable that a ram could spread infection mechanically from ewe to ewe in a flock merely from the fact of having been contaminated by an aborting ewe, because, in the great majority of cases, both rams and ewes, when the breeding season begins have been excluded from sexual intercourse for nearly a year, and the ewes must have been free from maternal duties, other than suckling, for about six months. There seems to be only the possibility that a ram from infected premises may be a carrier of infection owing to the upkeep in some way of virus in its body, but of this being actually the case there is no evidence of any consequence.

Symptoms. — No particular symptoms in connection with abortion seem to have been observed in the field except just before the act, when, if the period of pregnancy is advanced, and it usually is, the ligaments are relaxed, the mammae and the vulva are swollen and a sanious, mucoid discharge is seen around the latter. It is pointed out that a pregnant ewe, which before her time shows soiling of the fleece by sanious material, should be regarded with great suspicion, and the discharge should be exam-

mined. The evidence from the field is that many of the foetuses are putrefying when expelled, and this seems to apply more particularly to those which have died in uterus at a comparatively early stage of pregnancy. It appears that the interval between infection and abortion varies between 13 and 113 days, and the percentage of abortions on infected premises averages about 23 per cent. As the result of abortion in ewes, inflammation of the womb is not uncommon, and this may end fatally especially when the contents of the uterus are putrid.

Distribution and Prevalence of the Disease. — Particulars indicating the distribution of the disease were obtained by the Committee by means of replies from farmers to circular letters of inquiry. The proportion of aborting ewes taken by the Committee as indicating that something definite had operated on the ewes was 10 per cent. and over; and of the 476 farmers from whom replies were received the proportion was 10 per cent. and over, on 70 farms (or 14.7 per cent), these infected farms being situated in 24 counties in England, 4 in Wales, and 6 in Scotland. The proportion of barren ewes on the 476 farms was also ascertained, as it was thought that an unduly high proportion might be ascribable to the ewes casting foetuses unobserved. The proportion of barren ewes was 10 per cent. or over in 26 flocks out of the 476.

Preventive and Remedial Measures. — No particular breed of sheep seems to possess natural immunity to the disease, although some individual animals are apparently more resistant to infection than others; and further, the evidence obtained by the Committee as to the resistibility of ewes which had already aborted was in no way conclusive. A few experiments were carried out to ascertain whether immunity could be conferred on ewes by subcutaneous injection of living cultures of the vibrio, but no preventive effects of any value were obtained. Fairly successful results were obtained with an anti-serum, but, owing to doubt as to the constant virulence of artificial cultures of the vibrio, no great importance can be attached to these experiments. Further investigations are proceeding in relation the possibilities of the serum and also as to drug treatment.

To prevent the spread of infection once the disease has broken out the following measures are recommended:

Destruction of Virulent Material and Disinfection of Everything contaminated by it. — This is obviously important. The membranes, foetus, the discharge, and any litter soiled by the material should be removed at once and destroyed. It is even preferable to destroy their virulence on the spot by mixing the material freely with caustic lime and slaking or enveloping it in straw soaked in paraffin and burning it. Any patches of the pen or pasture which are known to have been soiled should be disinfected with a strong disinfectant. The boots, clothing, and hands of attendants should be disinfected.

Isolation of aborting animals and those which have aborted. — When a ewe shows before her time a discharge from her genital organs, or should she abort, it is essential that she should be removed from contact with her fellows. The same applies to ewes which have given birth to live lambs

prematurely, in which case both the ewes and lambs may be excreting infective material. It would be preferable, of course, to remove the still pregnant ewes when this is possible.

Penning or Folding of Ewes before Lambing. — In some cases it is customary to pen ewes at night towards the end of pregnancy, and it is also not unusual to fold them by hurdles to feed on certain crops. As far as abortion is concerned, these practices may do no harm, so long as there are no infected ewes in the flock; but given one or two cases of abortion occurring in the narrow area of a pen or fold, it will be obvious how great will be the opportunity for other ewes to become infected, and it is pointed out that a ewe may abort from infection acquired only a short time before her normal time to lamb. Of the 70 farms referred to above as having experienced 10 per cent. or more of abortion, 46 were in the habit of penning or folding their ewes some time before they were due to lamb.

It is advisable, then, not to adopt these practices if they can be avoided but if they are adopted the greatest vigilance should be exercised in watching for cases of abortion. Should such occur, two courses are open either to destroy all evacuated material, disinfect the ground, and remove the ewe, or immediately to remove the other ewes to clean ground. The second course is the more to be recommended, if it can be carried out.

Disinfection of the Genital Passages of Ewes which have aborted. — This may be done by gently injecting an antiseptic wash (3 per cent. pure carbolic acid in water, or corrosive sublimate 1 in 2 000) by way of the external genital organs. It is advisable to carry out this treatment, because it may have the effect of destroying a certain amount of virulent material which has passed from the uterus into the vagina, and it may also help to prevent further invasion of the passages and womb by harmful microbes from without. Ewes which have aborted should be put in improvised pens, and treated in the same way until the discharge ceases.

From the breeder's point of view, early maturity does not necessarily signify early sexual maturity, but only accelerated growth. Investigations have shown that this growth is influenced by the internal secretory glands (thymus, thyroid, pituitary, etc.) which are complementary organs to the sexual glands. It follows that the sexual glands also must be an important factor in growth. As a proof of this the writer mentions a fact he observed in some of his experiments, namely that unilateral castration caused changes in the growth of the skeleton. The early development of the sexual cells must naturally first affect the sexual characters. Independently of this influence, the development of the sexual characters depends also upon the energy of growth belonging to the corresponding part of the body. •

Early maturity is not, as SANSON assumed, exclusively dependent upon nutrition, which is its principal determining factor, but is also influenced

to a great extent by the specific nature of the animal, *i. e.* by the activity of its internal secretory glands.

Changes in the form of the organs of digestion and principally the increase of their weight or volume cannot be considered as certain signs of early maturity. It seems in fact that, in this respect, there is no difference between early and late maturing animals. On the other hand the connection between the physiological activity of the digestive organs and early maturity is certain.

On the development of the teeth early maturity seems to act in various ways. The temporary teeth are not much influenced by it while the permanent ones are to a greater extent. The individual teeth also behave differently: the incisors in early maturing animals develop before the molars and the first incisors grow more rapidly than those near the molars. Among the domestic animals cattle especially are liable to a premature appearance of the permanent dentition. Normally the permanent teeth are all up at the age of three years, but early maturity can shorten this period to two years. According to CORNEVIN the premature change of teeth can take place in three ways: 1) by the premature fall of the first incisors; 2) by the loss of the first incisors at the normal time followed by the loss of the other incisors at rapid intervals; 3) by the more or less simultaneous loss of all four incisors. The growth of the permanent teeth varies considerably with the degree of early maturity of the animals and CORNEVIN has distinguished three degrees as follows:

	1st degree of early maturity		2nd degree of early maturity		3rd degree of early maturity	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
	months	months	months	months	months	months
Change of 1st incisors	14-15	12	18	14	19-20	16
" 2nd "	18	16	24	18	28-30	20
" 3rd "	24	19	28-30	24	35-37	27
" 4th "	29-31	26	37-39	32	40-45	26

In the early maturing breeds of pigs the early appearance of the milk teeth can be observed. The early change of teeth is however not so noticeable as in ruminants.

Horses have not yet been sufficiently studied in this respect; cases of early development of teeth have been observed, but they appear to be rare.

The influence of early maturity on the conformation of the body and especially on the formation of the skeleton is connected with the effect of selection and of environment. Early maturity resulting from better feeding in favourable environment generally leads to increase in the size of the body and to a shortening of the limbs.

The system of management under which the animals are kept has a great influence on the early maturity of the muscles and internal organs. According to BAUDEMENT breeds which can be forced by high feeding have less voluminous and consequently lighter lungs. SEEBERGER always found heavier lungs and hearts in the late maturing sheep of Franconia than in the early maturing Southdowns. Similar differences have been observed amongst draught horses.

The skin, hair and horns become finer in early maturing animals, but this influence may be counteracted by other conditions such as climate.

With regard to the question whether early maturity and great fecundity may occur together, the writer states that the early maturity of the sexual organs and that of body in general may be independent of each other as is proved by the great fecundity and remarkable genetic power of many early maturing animals. In the same way a high milk yield and early maturity may be found in the same animal (Bate's strain of shorthorns). The combination of high milk yield and early maturity requires well developed and active sexual glands.

Whether early maturity shortens the life of the animal and the period of certain physiological functions (duration of pregnancy, of sexual life, etc.) has not yet been fully ascertained. It would seem that the duration of pregnancy is somewhat diminished by it.

FEEDS
AND FEEDING.

448 - **Studies on Phytin.** — ANDERSON, R. J. (New York Experiment Station) in *The Journal of Biological Chemistry*, Vol. XVII, No. 2 pp. 141-190. Baltimore, March 1914.

The organic phosphoric acid isolated by the writer from cottonseed meal (1), on more detailed examination of the barium salts and of the free acid, proved to have a formula which did not correspond exactly to the one usually attributed to phytic acid, but rather to that of inosite hexa-phosphate. The same phosphorus compound was isolated from oats and from maize, and finally from commercial phytin, so that it would appear that the organic phosphoric acid known as phytic acid is either inosite hexa-phosphate or an isomer of the same.

BREEDING,

449 - **Multiple Factors in Mendelian Inheritance.** — MACDOWELL, R. C. (Bussey Institution) in *The Journal of Experimental Zoology*, Vol. XVI, No. 2, pp. 177-193. Philadelphia, Pa., February 20, 1914.

A small male rabbit of the Himalayan breed was crossed with a series of females belonging to a larger race, and the F_1 females resulting from this cross were also mated with their original small parent. The bones of the rabbits when full grown were measured in sixteen different ways, and from the data thus obtained the *coefficient of size* for each individual was calculated as follows: the mean of each character for a fraternity was divided by the value of that character for a single individual and the average of the quotients for all the characters gave the coefficient of size for any one animal.

(1) See No. 257, B. March, 1914.

In order to compare the variability in the F_1 generation with that of the second cross, the animals were classified according to their coefficients of size and the standard deviation of the different classes was estimated. The data was also treated in order to show the relationship between the parents and each set of offspring considering only one character at the time; and, lastly, the variability of the body weights was compared. The results all point to the fact that there was greater variability in the second, cross than in the F_1 generation, indicating the presence of multiple Mendelian factors.

450 - Budget of the Prussian State Studs for 1914. — GENIESER, E. in *Deutsche Tageszeitung*, No. 134, 3rd supplement. Berlin, March 14, 1914.

HORSES,

The budget of the Prussian State studs for 1914 gives the following data on the present conditions of the studs in Prussia:

There are 5 principal and 18 provincial studs which are stocked as follows:

38 stallion	} for the five principal studs:	
2730 brood mares		Graditz, Trakehnen, Beber-
480 young stock		beck, Neustadt (Dosse) and
		Georgenburg.

and 3645 provincial stallions in the 18 provincial studs:

	with	181	stallions
Rastenburg, East Prussia	»	190	»
Braunsberg, »	»	235	»
Georgenburg, »	»	235	»
Gutwallen, »	»	176	»
Marienwerder, West »	»	165	»
Pr. Stargard, »	»	227	»
Neustadt-Dosse, Brandenburg	»	175	»
Labes, Pomerania	»	200	»
Zerke, Posen	»	236	»
Gnesen, »	»	185	»
Lenbus, Lower Silesia	»	210	»
Cosel, Upper »	»	150	»
Kreuz, Pr. Saxony	»	130	»
Traventhal, Schleswig-Holstein	»	400	»
Celle, Hanover	»	192	»
Warendorf, Westphalia	»	152	»
Dillenburg, Nassau	»	206	»
Wickerath, Rhine province	»		

Total 3645

The total number of horses of both sexes including thoroughbreds, half breeds and heavy draught animals is 6943.

For the upkeep of the studs the following sums are estimated:

Ordinary expenses	£558 462
Ordinary income	255 037
	<hr/>
Difference	303 425
Extraordinary expenses	52 459
	<hr/>
Total outlay	£355 884

or £45 901 more than the State had provided for 1913. The ordinary expenses include the following items: salaries, management, feeding, expenses for racing at Graditz (£19 600) and purchase of horses (£118 090).

On the other hand the ordinary income is made up as follows:

Sale of horses at principal studs	£ 36 224
» » » » provincial »	9 666
Service fees and sale of foals	149 078
Produce from land and farms	26 197
Sundries.	33 823
	<hr/>
	£254 988

Among the extraordinary expenses there are £14 700 for exceptional purchases of horses, and £17 650 as a provisional instalment for the purchase of land intended for a State stud for thoroughbred horses at Altenfeld in the Cassel district. The rest of the extraordinary expenses is almost exclusively devoted to new buildings and enlargement of old ones at the existing stud farms.

Of the 3645 stallions of the provincial studs 2845 are thoroughbreds and half breds and 800 are heavy draught horses. To keep up the stock 341 thoroughbreds and half breds (12 per cent.) and 120 heavy horses (15 per cent.) are required per annum. Of the 341 thoroughbred and half bred stallions required for 1914, 95 will be supplied by the principal state studs, so that only 246 stallions will have to be bought, namely 20 thoroughbreds and 226 half breds. All the 120 heavy draught stallions will have to be bought as the Prussian State does not breed them. The price paid for half bred and heavy draught stallions in former years has been on an average about £206. In 1914 their average price is estimated at £245. For the 20 thoroughbred stallions the estimate is £735 each.

In the budget for 1914 a sum of £9800 is set apart as an instalment for the bi-annual purchase of a first class thoroughbred stallion worth £19 600. Besides this, two good thoroughbred stallions worth £5880 together are also to be purchased. As in preceding years two thoroughbred mares will be purchased for the thoroughbred stud of Graditz at an average price of £1470.

In order to meet the demands of the increased armaments voted in the autumn of 1913, the studs have increased the number of their stallions by 55 in eight studs; the number of brood mares has been increased at Neustadt from 60 to 70. The extraordinary expense caused by these increases amounts to £14 700.

451 - **The Limits of Error in Milking Tests at Intervals of One and Four Weeks.** - MARTINY, B. in *Arbeiten der Deutschen Landwirtschafts gesellschaft*, Part 254, pp. 27-32. Berlin, February 1914.

During a five weeks trial of Sharples' milking machine conducted at the Wrechen Estate, Mecklenburg Strelitz, on 20 black and white lowland

cows, total yields obtained were compared with those calculated from weekly tests (1). The results are tabulated in the adjoining table :

Differences between actual milk yields and those calculated from weekly tests.

Cow	actual yield during the 4 weeks in kilog.		Maximum differences									
			in Kilog.				per cent.					
			Milk		Fat		Milk			Fat		
	Milk	Fat	+	-	+	-	+	-	together	+	-	together
1. . . .	353.6	9.55	6.5	13.1	0.31	0.25	1.8	3.7	5.5	3.2	0.7	3.9
2. . . .	454.4	14.32	23.4	10.0	0.85	0.52	5.1	2.2	7.3	5.9	3.6	9.5
3. . . .	329.0	10.49	9.8	9.8	0.32	0.58	3.0	3.0	6.0	3.1	5.5	8.6
4. . . .	343.2	12.02	4.3	24.3	0.44	0.57	1.2	7.1	8.3	3.7	4.7	8.4
5. . . .	418.2	13.16	6.3	8.3	0.50	0.73	1.5	2.0	3.5	3.8	5.5	9.3
6. . . .	478.5	13.57	9.5	5.3	0.39	0.58	2.0	1.1	3.1	2.9	4.3	7.2
7. . . .	456.9	11.68	10.1	12.8	0.47	0.62	2.2	2.8	5.0	4.0	5.3	9.3
8. . . .	451.5	14.03	12.7	9.4	0.78	0.70	2.8	2.1	4.9	5.6	5.0	10.6
9. . . .	356.1	10.55	9.6	13.9	0.20	0.11	2.7	3.9	6.6	1.9	1.4	3.3
10. . . .	399.7	11.02	7.7	7.4	0.43	0.18	1.0	1.0	2.0	3.9	1.6	5.5
11. . . .	315.9	8.63	8.6	7.1	0.67	0.40	2.7	2.2	4.9	7.8	4.7	12.5
12. . . .	333.0	10.27	12.5	5.4	0.84	0.58	3.7	1.6	5.3	8.2	5.6	13.8
13. . . .	393.9	12.55	12.5	15.9	0.58	0.31	3.2	4.0	7.2	4.6	2.5	7.1
14. . . .	343.1	10.88	4.9	2.6	0.32	0.24	1.4	0.8	2.2	2.9	2.2	3.1
15. . . .	331.3	10.21	8.3	15.8	0.49	0.38	2.5	4.8	7.3	4.8	3.7	8.5
16. . . .	384.9	12.66	11.9	14.2	0.89	0.98	3.1	3.7	6.8	7.0	7.7	14.7
17. . . .	261.3	8.52	4.9	5.8	0.24	0.20	1.9	2.2	4.1	2.8	2.3	5.1
18. . . .	334.8	10.30	9.6	15.1	0.56	0.61	2.9	4.5	7.4	5.4	9.5	14.9
19. . . .	283.4	6.71	6.6	5.3	0.11	0.26	2.3	1.9	4.2	1.3	3.0	4.3
20. . . .	265.6	8.60	5.7	6.6	0.47	0.28	2.1	2.5	4.6	5.5	3.3	8.8
lowest	261.3	8.52	4.3	2.6	0.11	0.11	1.0	0.8	2.0	1.3	0.7	3.1
highest	478.5	14.32	23.4	24.3	0.89	0.98	5.1	7.1	8.3	7.0	9.5	14.9
average	360.4	11.09	9.27	10.4	0.49	0.45	2.5	2.8	5.3	4.4	4.1	8.4

Differences between the two sets of results are already considerable when the tests are made once a week (maximum for milk ± 4.15 per cent., for fat ± 7.45 per cent.) and it may be assumed that if the interval

(1) Cfr. *Arbeiten der Deutschen Landwirtschafts gesellschaft*, part 211, pp. 25-32. Berlin 1912.

between tests were extended to two or three weeks the differences would still be greater. Sampling once in four weeks gave the following differences :

Milk, average difference . . .	\pm 10.7	per cent
Fat " " . . .	\pm 16.4	"
Milk, maximum difference . . .	\pm 17.1	"
Fat " " . . .	\pm 27.05	"

The total yield and the fat content of milk are thus subject to such considerable variations that weekly milking tests are barely sufficient to determine large differences in the milk yielding power of individual cows in herds possessing but little uniformity ; in more uniform herds neither fortnightly nor weekly milking tests are sufficiently reliable. Especially where a very high standard of production is required, success is out of the question unless the the milk yield of every cow is determined daily.

POULTRY.

452 - **Twelve Months Poultry Laying Competition.** — RHODES F. W. in *Report of the Harper Adams Agricultural College* pp. 1-49. Newport, Salop, 1913.

The competition took place at the Harper Adams Agricultural College Newport, Salop, and lasted from October 15, 1912 to October 14, 1913.

A hundred pens, of six birds each, took part in the competition and the following breeds were represented :—

Ancona	4 pens
White Leghorn	18 "
Black Leghorn	3 "
Croad Langshan	3 "
White Wyandotte	33 "
Black Wyandotte	1 "
Silver Laced Wyandotte	1 "
Black La Bresse	3 "
Buff Orpington	13 "
White Orpington	1 "
Buff Rock	7 "
Barred Rock	1 "
Salmon Faverolle	2 "
Rhode Island Red	7 "
Red Sussex	1 "
Silver Campine	1 "
Black Minorca	1 "
100 pens	

Trap nests were used exclusively and the eggs, were graded into three classes according as their weight was above 2 oz., between $1\frac{1}{2}$ and 2 oz., or below $1\frac{1}{2}$ oz.

The winning pen consisted of white wyandottes with an average record of 231.5 eggs per bird (the average record of all birds in the competition being 151.9 eggs per bird), and the breed generally was most successful, taking five out of the six best positions in the competition. Medium sized birds proved better layers than the heavier birds of each breed and the average score of the birds which laid ten eggs during the

first month was 187.5 while the average of those which did not begin to lay till after the second or third month was 135.8 and 106.3 respectively (1).

The birds received two meals per day — a feed of mixed grain in the morning and a warm mash in the afternoon, as they flourished better under this system of management than when the order of the meals was reversed. The cost of the food worked out at 1.8*d.* per head per week or 0.6*d.* per egg produced. About 75 per cent. of the eggs could be graded in the class above 2 oz. in weight while only a negligible number were in the class below 1 ½ oz. in weight.

453 — **Some Physiological Observations Regarding Plumage Pattern.** — PEARL, R. and BORING, A. M. (Papers from the Biological Laboratory of the Maine Agricultural Station, No. 60) in *Science*. Vol. XXXIX, No. 995, pp. 143-144. New York, January 23, 1914.

A study of the successive regeneration of feathers, carried out by tattooing a circle with india ink round each follicle selected for observation. The investigation has lasted for eighteen months and the present paper, which is a provisional report, records, the following facts:

Feather follicles will not reproduce feathers indefinitely between moults. Usually the body feathers are reproduced three times but the number of regenerations varies both with the bird and with the kind of feather, being largest on the wing primaries.

A follicle made quiescent by successive removals of the feather will, however, again become active after a general moult.

The pattern of the feather is usually faithfully reproduced in the new feathers, but when feather production is forced by removal of the feather as soon as it is fully grown, the pattern tends to be gradually broken up. Finally the secondary sexual feathers of the males are produced from follicles which originally bear undifferentiated body feathers, and if the latter be removed before the natural moult, the secondary sexual feathers will be developed prematurely.

454 — **The Odour of the Flesh of the Coot.** — BLAHA, SIGISMUND in *Hoppe-Seyler's Zeitschrift für Physiologische Chemie*, Vol. 89, Part. 6, pp. 456-464. Berlin, March 17, 1914.

As the result of numerous analyses of fats the writer comes to the conclusion that the disagreeable odour of the flesh of the coot (*Fulica atra*) is due more especially to the presence of monomethylamine.

455 — **The Silk Industry in Japan during the Reign of the Late Emperor Meiji.** — HONDA J. in *Bulletin de l'Association Sericicole du Japon*, Year 1, No. 4, pp. 8-10. Tokio, December 1, 1913.

SILKWORMS.

Agriculture in Japan during the reign of the late emperor Meiji is distinguished by the great development of sericulture, due, to a great extent, to the personal support of the monarch. This is especially evident in the comparison made in Table I between the values of the exports of the first years of that emperor's reign (1867) with these of 1890, the year follow-

(1) See No. 363, *B.* April 1914.

ing the proclamation of the constitution, and with those of 1911, the year which preceded his death.

TABLE I.

Year	Raw Silk £(1)	Silkworms' eggs £	Other products £	Total £
1867	625 347	371 225	39 859	1 036 431
1890	1 385 934	8.14	293 701	1 680 479
1911	12 703 335	0	945 528	13 648 853

(1) 1 yen is taken as = 2s

(Ed.).

From the above it appears that Japan exported considerable quantities of silkworms' eggs during the first years of the emperor's reign, that this exportation gradually diminished while that of raw silk increased. The latter rose constantly from 1875, and in 1911 it was 19 times greater than it had been in 1867.

The increase of the production of silk and of the area planted to mulberries is shown in Table II in which the figures for 1878, 1890 and 1911 are compared.

TABLE II.

Year	Acreage under mulberries acres	Production		
		Raw Silk lbs	Cocoons bushels	Silkworms' eggs packets
1878	531 703	2 991 508	4 642 214	1 387 139
1890	547 558	7 781 994	5 775 667	2 295 004
1911	1 099 342	26 585 815	20 950 100	8 188 041

The values of the products of sericulture exported during the reign of the late emperor are grouped together in Table III.

TABLE III.

Years	Value of the products			
	Raw Silk £	Silkworms' eggs £	Other products £	Total £
1867-1889.	30 717 637	2 132 445	770 157	33 620 239
1890-1911.	164 769 960	2 290	53 706 744	218 478 994
Total . . .	195 487 597	2 134 735	54 476 901	252 099 233

While Japan was inferior to Italy and China as a producer of silk in 1867, she overtook and passed Italy in 1871, and China in 1902, and is now the greatest producer of silk in the world.

456 - **Comparison Between Silk Cocoons Produced by Feeding the Worms on Standard or Dwarf Mulberry Leaves.** — NAKAMURA M. M. in *Bulletin de l'Association Séricicole au Japon*, Year 1, No. 3, pp. 6-7. Tokio, November and December 1913.

Some silkworms of a Japanese breed (Aojuku) and some of a French breed (Var) were fed on leaves taken from standard mulberry trees. Other worms of the same breeds were fed on leaves from dwarf mulberries. The cocoons that were produced from both lots of worms were compared in order to ascertain if the form given to the tree has any effect on the quality of the cocoons produced. The results may be grouped as follows:

1. The length and resistance of the thread of the cocoons produced by the worms fed on dwarf mulberries were greater than those of the lots fed on standards.

2. The total nitrogen content of the cocoons was approximately the same in both lots. The content of monoamino acids was greater in the lot fed on dwarf mulberry leaves.

3. In ash content a difference was noted only in the Japanese breed, the standards fed lot giving higher values. The lime and potash content of the ash was also greater in the standard fed lot. The phosphorus content was the same in both lots.

4. The solubility in water of the dry matter seemed to be the same for both lots; but the specific gravity of the cocoons produced by the standard fed worms was greater than that of the other lot.

5. The weight of the reeled silk obtained from the standard fed lots was always inferior to that from the dwarf fed lots.

FARM ENGINEERING.

457 - **Mechanical Tillage Experiments at Grignon, France.** PILLAUD H. in *La Technique Moderne*, Year 6, 1st half-year, No. 1, pp. 21-25, January, 1914.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

The experiments on mechanical tillage organised by the French Ministry of Agriculture on the estate of the Grignon Agricultural College meet a long-felt want of farmers and agricultural machine builders.

In the absence of comparative tests, farmers have not yet decided which types of machines are best adapted to the various farm operations. Information is required as to the amount, quality and cost of the work of the various machines and on the services other than tillage that they can render. In America some important competitions have been held, especially at Winnipeg, which have supplied precise data, but most of them refer to machines unknown in France and to other conditions of farming.

In Europe there have been several tests and competitions, among which the best known are those of Prague, Vienna, Breslau and recently at Chassart. In France and Northern Africa, among others, the trials carried out at Creil,

Chaumont-en-Vienne, Bourges, Algiers, and Tunis have yielded data on the work of several outfits and on its cost per acre.

Unfortunately the means available for these tests have generally been insufficient and it is with the object of obtaining very complete results that the French Ministry of Agriculture has organized these experiments at Grignon which were commenced in October 1913, and are to be continued for some years. In doing so the Ministry developed the plan of the Société des Agriculteurs de France in the trials organised by them at Puiseaux, enlarging its scope and including in the undertaking the agricultural associations most interested in motoculture, such as the above mentioned Association, the Société Nationale d'Agriculture de France, the Société Nationale d'Encouragement à l'Agriculture, the Automobile Club de France and the Comité Français de Culture Mécanique.

The programme provides for the following test:

CULTURAL EXPERIMENTS.

1. *Obligatory tests.* The competing machines must perform two winter ploughings for sugar beets to a depth of between 10 and 14 inches, in one of which farmyard manure is to be ploughed in; one winter ploughing after wheat to a depth of between 8 and 10 inches; and a fourth as light as as possible (4 inches deep at most) after beets, ploughing in the leaves.

2. *Optional tests.* A winter ploughing to a depth of 14 inches with sub-soiling from 4 to 8 inches; a winter ploughing 10 to 14 inches deep, at the same time ploughing in a catch crop; breaking up of grass leys and trials for scuffling, harrowing, rolling, cultivating and harvesting.

In each plot one portion is cultivated in the customary fashion to allow of comparisons being made between the results of team and mechanical work both of which are carried out at the same time and under the same conditions.

MECHANICAL EXPERIMENTS.

Besides the cultural experiments, which are the most important as they show the practical value of each machine, these are also submitted to scientific examination bearing on the following points: study of the motor and of the transmissions; mechanical experiments in the field as to the power of each machine; its consumption when working at various depths etc; and cultural experiments in order to determine the agricultural value of the different work compared with that effected by the usual means.

Only French builders or representatives of foreign firms entering machines built in France are admitted; some foreign machines have however been authorized to enter for the competition but without being entitled to indemnities or prizes.

The following twelve outfits are taking part in the trials :

A. French machines:

Tractors: Edmond Lefebvre.

Outfits with windlasses and cables: A. Bajac and Doizy.

Tractors hauling on a cable: G. Filtz.

Motor ploughs and hoes: Banche, Benedetti and Dubois.

Special systems with rotary diggers: Derguesse Tourand, Le Motoculteur Co., Vermond-Quellenec.

B. Foreign Machines:

Tractors: International Agricultural Machine Co.

Motor ploughs: Stock.

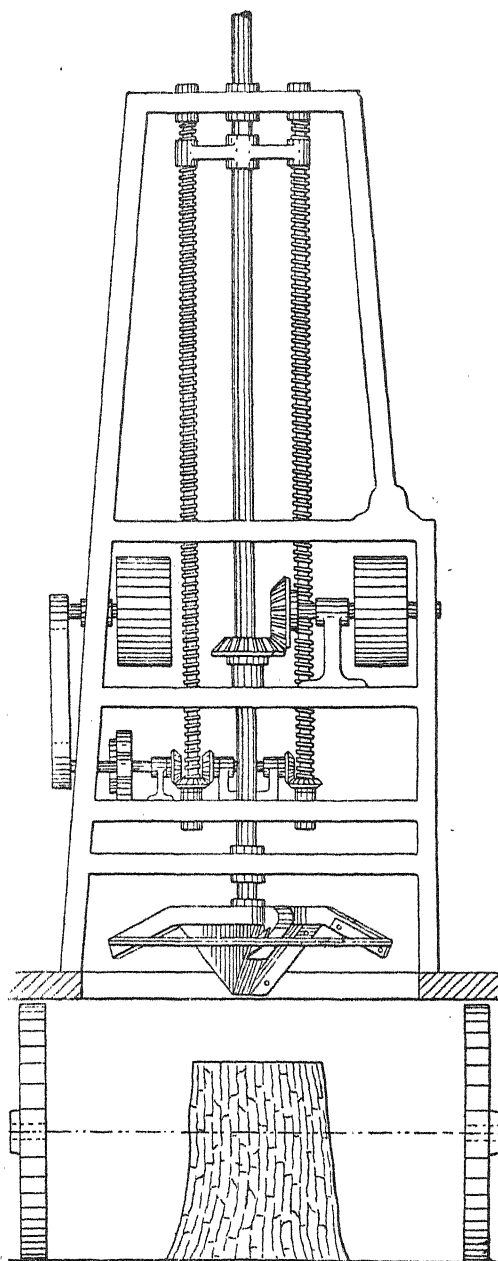
458 - **Stump-Cutting Machine.** — *Engineering Record*, Vol. 69, No. 10, p. 146.
New York, March 7, 1914.

A machine for cutting down stumps 6 in. and more in diameter has been devised and patented by A. L. and G. D. MOORE of New Orleans. The machine is shown in the accompanying sketch; it is strongly built and can be attached to any tractor. In working it is propelled to the stump and the cutter head is made to revolve at 400 revolutions per minute. The cutter head is lowered by a friction feed operated by a rocking lever. The thickness of the chips or shavings is regulated by the feed screws.

The cutter can be regulated so as to penetrate 18 inches below the surface of the ground, if necessary, so as to consume all the stump, leaving only the minor roots.

The cutter head is so formed that, with the velocity of working, the chips are thrown upwards by a centrifugal motion. The chips are guided by a hood or jacket and are blown in one direction so that they can be sacked or carted away. The principal object of the machine is to clear cut-over lands from stumps, leaving the land ready for cultivation. At the same time the stumps are cut into small chips which can be used for the manufacture of by-products such as wood pulp.

It is worked by two men and the cost of the oil fuel is estimated at \$3 per day of 10 hours.



Stump-Cutting machine

459. — **Trial of Sharples' Milking Machinery.** — MARTINY, B. *Arbeiten der Deutschen Landwirtschafts Gesellschaft*, Part 254, pp. 53 with figs. Berlin 1914.

The milking machinery built by Sharples according to Macartney's invention consists of a vacuum apparatus, a set of air pipes, a pulsator and a can connected with four teat cups by rubber pipes. The can is patented in Germany under No. 260 631.

The *vacuum apparatus* is composed of two suction and force air pumps mounted on the same frame, of a driving pulley and of two air reservoirs of unequal size, the larger one being for the rarefied air and the smaller one for the compressed air.

The *air pipes* are common gas pipes, one inch in diameter for the rarefied air, and half an inch for the compressed air. They are suspended from the ceiling of the stable by a hanger between every two cows, which supports also the pulsator and the connection between it and the pipes. Each of the latter is also provided with a manometer (see Fig. 1, in which *a* are the over head pipes, *b* the pulsator, *c* the milk can and *d* the teat cups).

The *pulsator*, which is fully described and illustrated in the paper, makes from 45 to 55 double oscillations per minute; the motion is irregular, and lasts longer during suction than during compression. It sends compressed and rarefied air alternately to the teat cups. The rapidity of the pulsations can be regulated, within certain limits.

The *milk can* has the shape of a truncated cone, is made of tinned steel and stands 15 inches high without its lid. Its capacity is about 3 gallons. A small piece of glass is let in near the lid through which the inflow of the milk can be watched. The lid is of solid tinned brass casting and can be fixed to the can and made airtight by means of rubber rings. It bears a handle with two hooks, on one of which the teat cups may be hung for convenience in carrying, while the other can be used for suspending the lid and cups on to the air pipes when the can is being changed. There are, besides, on the lid a relief valve and a cock, the former to prevent the milk from getting into the air pipes when the can is too full and the latter to allow the milk from the teat cups to flow into the can.

In the lid, two tubes are fastened, one leads from the relief valve to the pulsator and conveys the rarefied air to the can, the other connects the central cavity of the rubber cylinder within the teat cups to the can. Through the handle on the lid a long pipe is passed which connects the pulsator with the space between the rubber cylinder and the outer steel cylinder within the teat cups (see Fig. 2).

The *teat cups* (shown in Fig. 2, *a* when milking begins and *b* when it ends) consist of hollow tinned steel cylinders slightly funnel shape at the top. They are 5.31 inches long. The cylindrical part is 1.55 inch in diameter, the top 1.67 inch. Within each steel cylinder there is a rubber cylinder 0.14 inch thick, and 1.10 inch in inner diameter, which receives the teat. Between the rubber and the steel cylinders there is a space of 0.15 inch into which compressed and rarefied air is driven alternately. Suction inside the rubber cylinder causes it to adhere firmly against the udder and draws

the milk out while the upper part of the rubber cylinder exerts an intermittent pressure on the teat by changes of pressure in the space outside the cylinder.

The complete milking outfit with pipes and pulsator weighs 26.3 lbs,

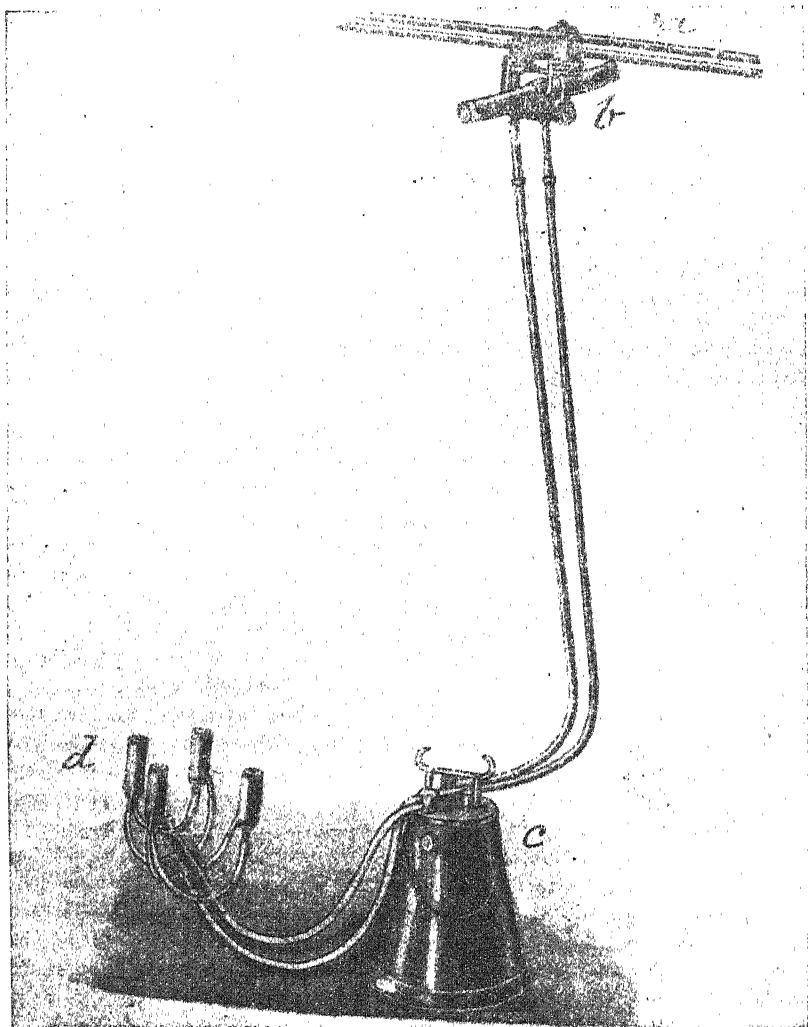


Fig. 1. — Sharples' milking machine.

the milk can without the lid 7.7 lbs and the lid alone 5.5 lbs. A teat cup with the rubber cylinder but without the pipes weighs 0.66 lbs. The weight of the 4 teat cups and tubes as they are borne by the cow weigh about 4.4 lbs.

Cost of milking plant. — The pumping apparatus sufficient for 500 cows costs about £24.10s. The overhead pipes for 25 cows about £1.14s and each milking set £22. The cost of a machine milking plant depends chiefly upon the number of milking sets required. Assuming that for every 25 cows to be milked in $1\frac{1}{4}$ to $1\frac{1}{2}$ hours two milking sets are necessary, and that a 2 HP electromotor costs about £22 and a 3 HP benzol motor about £49, the whole plant complete would cost :

			£	s	d		£	s	d	
for	25 cows.	from	3	18	9	to	4	15	1	per cow.
"	50 "	"	2	15	3	"	3	6	0	"
"	75 "	"	2	9	1	"	2	16	4	"
"	100 "	"	2	6	0	"	2	11	4	"

This apparatus is very costly for small dairies. Of course the cost diminishes if the pumps can be driven by existing power machinery or by horse or bullock gears or when the motors can be used for other work besides milking.

Trial of endurance. — These milking machines were used for some time on 80 cows at Herr SEIP'S estate at Wrechen, Mecklenburg Strelitz, the work being done by two men with three machines each followed by a woman stripping by hand. The power was produced by an 84 HP electromotor which, however, also drove a chaff cutter, a pump and an oil cake crusher.

In the same estate in June and July 1913 a trial of endurance of the plant was made on 20 cows weighing on average 990 lbs. each which were milked by one man with three machines. The same man did the stripping by hand also. The quantities of milk obtained by the machine and by stripping were carefully weighed and measured and examined for fat content and specific gravity. The food given to the cows during the same time was weighed and recorded. The following points were also investigated :

1. *The behaviour of the cows towards machine milking.* — During the whole time the experiment lasted, none of the cows showed any objection to being milked by the machine, not even those heifers which were not easy to milk by hand.

2. *State of health of the cows.* — While the general health was good throughout, the udder was positively benefited by the gentle intermittent pressure on the teats as a substitute for the rougher treatment of hand milking.

3. *The quantity and quality of the milk* did not seem in any way to be affected by machine milking.

4. *The time employed in milking.* — Twenty cows were milked by one man with three machines morning and evening. Each milking, including stripping, took on average 59.1 minutes, thus one cow was milked by one machine in approximately 9 minutes. The total quantity milked daily averaged 578.38 lbs or 289.14 lbs per milking. Consequently 1 machine would have milked 100 lbs in 61.3 minutes or 97.68 lbs per hour from cows yielding an average of 28.93 lbs per day.

The results were somewhat different with the other 60 cows of the herd. When milked by 2 men with 6 machines and a woman for the stripping, one machine milked 82.06 lbs of milk per hour from cows yielding 15.4 lbs per day besides which the woman employed 41.6 minutes for stripping 14.47 lbs of milk. The difference in the performance of the machines is chiefly due to the greater quantity of milk yielded by the 20 cows. The time employed in milking by machine depends on how far the machine is allowed to complete its work. It is not advisable to let the machine milk

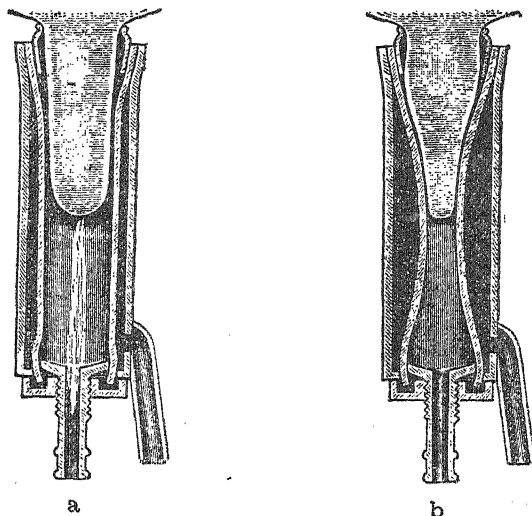


Fig. 2. — Teat cup:
a) When milking begins
b) when milking ends.

a cow dry because in the first place the milk flows so slowly towards the end that it is stripped quicker by hand, and in the second place stripping by hand is necessary to ascertain the state of health of the udder.

Besides actual milking, the time required for cleansing all the parts that come into contact with the milk has to be considered. At Wrechen the daily rinsing of the three machines took only 3 minutes and the weekly cleansing with soda averaged 23 minutes. Between one milking and the next the rubber pipes were kept in lime water. The writers however consider the above cleansing to be somewhat too hastily and inadequate.

Motor power required. — At Wrechen an 8 HP electromotor was used. When 80 cows were milked with 6 machines, at each milking an average of 742 lbs of milk were obtained in 82 $\frac{1}{2}$ minutes and, approximately 5 kw. were used, or for 100 lbs of milk 0.67 kw. But as the above motor drove the shafts and pulleys for other farm machinery it is estimated that an average of 2.75 kw. would be sufficient or 0.36 kw. per 100 lbs of milk.

Depreciation of plant. — As this plant has been in use only about a year no conclusion can yet be drawn as to its durability; still with careful handling one tenth of the cost per annum ought to be ample to cover wear and tear.

Cost of machine milking. — The cost of the milking plant for 80 cows, in working order may be estimated at £186. Calculating the yearly interest and wear and tear at 15 per cent. or £2718 s.

the share of this item for each milking is	9.18d
the labour of two machine milkers for 1½ hours per milking at 3.53d per hour	10.59 "
the labour of one hand stripper, 1½ hours at 5.88d per hour	8.82 "
the daily, weekly and monthly cleansing of the machine per milking	0.47 "
electric power 2.75 kw. at at 3.53d per kw. hour	9.65 "
lubricants and sundries	0.47 "
Total	3s 3.18d

Thus 1485 lbs of milk from 80 cows obtained in two milkings cost $2 \times 3s\ 3.18d = 6s\ 6.36d$.

or the cost of machine milking 100 lbs of milk is . . . 3.27d
and " " " " 1 cow 0.98d

Comparing the above with the cost of milking by hand, labour being paid 3.53d per hour, the former is 15 per cent. dearer.

Conclusions. — 1. That from the technical point of view Sharples' machine gives very satisfactory results.

2. That Sharples' milking machines are not economically advisable for a herd of less than fifty cows unless a cheap source of power is available.

3. That the current opinion that any farm hand is capable of milking with a milking machine is erroneous. On the contrary it requires an intelligent, careful and conscientious worker who is not only a good stockman but also a good mechanic.

4. That stripping by hand is always necessary, not only to ensure thorough milking but also because it allows the immediate detection of anything wrong with the udders.

5. That in order to avoid interruptions in the working, the plant must be frequently examined and duplicates of the essential parts kept in reserve.

6. That cleaner milk can be obtained by machine milking, provided all the parts coming in contact with the milk be carefully cleansed every time they are used and the stable be kept scrupulously clean, for which the Dutch system is especially suitable (1).

That for the trial of a milking machine never less than twenty cows should be employed.

(1) See, Prize essay of the German Dairy Association on the Dutch stabling system, *Schriften des Deutschen Milchwirtschaftlichen Vereins*, No. 34. Leipzig, 1908.

8. That the special features of Sharples' milking machine are not only "new and remarkable" but deserve special recognition and the award of the large silver medal.

460 - **A New Milking Machine.** — LUCAS. J. E. in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 10. Paris, March 5, 1913.

The Alfven milking machine is a pressure milker. The pressure is exerted between a metal plate and some rubber fingers which work like the fingers of the human hand. There are four sets of fingers with their respective plates (in order to be able to milk the four teats at the same time) fixed on one frame and mounted radially to a central axis.

The counterplates (E, fig. 2) are double walled; the nearer wall is fixed during milking, and forms with the second wall a firm spring which

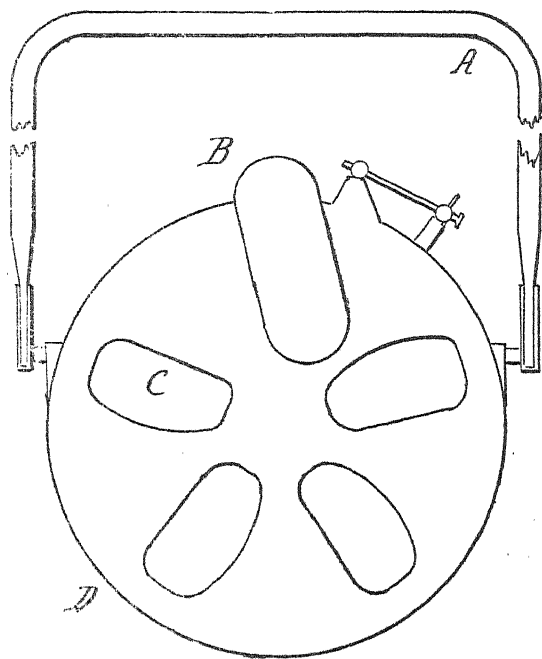


Fig. 1. — Alfven milking machine.

is sufficiently flexible however to press against the teat without injuring it in any way.

The sets of four fingers are arranged crosswise (see fig. 2, V) round a central axis and are moved by a set of cams which act on metal loops, T, fixed to the fingers and mounted on a fifth radial piece of the apparatus.

Six series of such crosses are placed one above the other. The cams are arranged so as to press each of the crosses in succession against the teat. The first series presses against the base of the teat, then successively the

second and the third. When the fourth begins to act the first begins to open; it is the same with the fifth and the second and the sixth and the third.

Thus continuing the pressure on the teat, the apparatus allows the milk to begin to flow again in the upper part of the same teat. A special compensating device allows the milker to be easily adjusted by one single screw to the different sizes of the teats.

The whole apparatus is covered by a metal plate (D, fig. 1) with four openings over the spaces between the fingers and the counterplate.

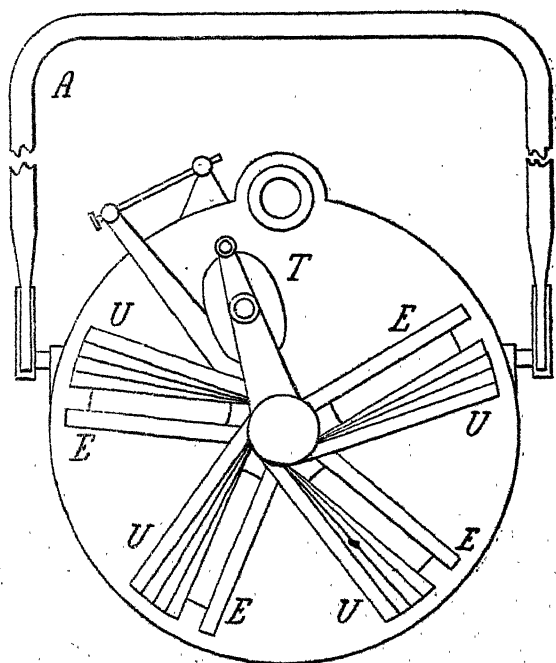


Fig. 2. — Alfven milking machine.

When it is required not to milk one of the quarters the corresponding aperture may be blocked by means of a suitably shaped small piece of wood.

The milker is suspended by a double belt over the cow's back. In front of the milker a spring handle (A, fig. 1 and 2) presses against the abdomen of the cow and keeps the milker in position over a funnel and milk pail.

The whole milker weighs about 22 lbs. It is worked by a small dynamo (B, fig. 1) attached to it and which requires the same electric power as a lamp of about 16 candle-power. The machine can be easily and quickly dismantled and cleaned.

Experiments with the above milker were carried out during 40 days on several lots of cows and no ill effects were noticed either with regard to the general health of the cows or the udders. On an average the machine drew 98 per cent. of the total milk and the amount obtained did not differ by 1 per cent. from the amount obtained from the control lot. The time employed in milking by hand was 5 minutes 20 seconds and with the Alfven milker 5 minutes 45 seconds; but one man can control three machines. Calculating the duration of the machine at 10 years, the yearly cost of milking a herd of 60 cows would be £188 with the milker, and £208 by hand.

461 - **Agricultural Machines Exempted from Customs Duties in Peru.** — *Landwirtschaftliche Maschinen und Geräte*, Year 14, No. 12, p. 41. Artern, March 1914.

The Government of Peru has published a decree according to which machines and parts of machines for the use of agriculture are admitted into the country duty free.

462 - **Fireproofing of Wood.** — *Engineering Record*, Vol. 69, N. 6, pp. 172-173. New York, February 7, 1914.

The question of fire proofing wood was included in the investigations of the Forest Products Laboratory at Madison, Wisconsin, U. S. A. in 1912.

A preliminary report was presented by ROBERT E. PRICE at the recent convention of the American Wood Preservers' Association of which the following is a summary:

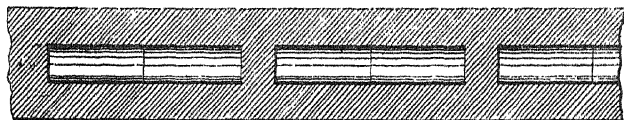
1. Ammonium salts are of considerable value in fireproofing wood. It was impossible to ignite wood, under the test conditions, that had been treated with these salts.

2. Borax is of considerable value in fireproofing wood. It has not the value of the ammonium salts, but promises a means of lessening the cost of treatment by using it with another salt of greater value.

3. From the good results already obtained it appears possible to devise a reasonably inexpensive method of rendering wood fire-retarding.

463 - **Cheap Stable Walls.** — *Schweizerische Landwirtschaftliche Zeitschrift*, Year XLII, part 7, p. 157. Zürich, February 13, 1914.

Recently stables have been built with hollow walls of cement or bricks. Where gravel is cheap concrete walls will be found very economical. For the



hollow spaces rejected drain pipes can be used; they can be bought very cheaply at brick and tile kilns.

In building the drain pipes into the concrete walls to it is important to tie the inner and outer surfaces every two or three lengths by leaving out the drain pipe and letting about 4 inches of concrete run right across.

Such walls have been built only 12 inches thick and their inner surfaces remain perfectly dry even in the coldest weather, while solid sandstone walls, 28 inches thick, get so cold as to condense moisture on their inner surface.

Fig. 1 shows a horizontal section of a 12 inch wall with 4 inch pipes built in.

464 - **Feeding Box for Poultry.** — *Technische Monatshefte*, Part 3, pp. 102-103. Stuttgart, March 7, 1914.

The feeding box shown in the accompanying figures keeps the food dry and clean and prevents its being stolen by sparrows or mice. When a fowl steps on the hinged board placed under the box, its weight causes the trap door in the lower part of the box to open and the food comes out as fast as it is consumed. When the fowl has eaten enough and goes away the counterweight closes the trap door immediately. The weight of a lighter animal such as a sparrow or a mouse is not enough to open the trap door.

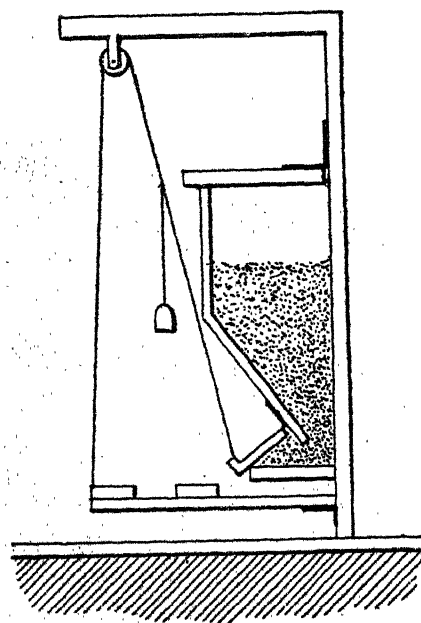


Fig. 1. — Feeding box for poultry. Trap door closed by counterweight.

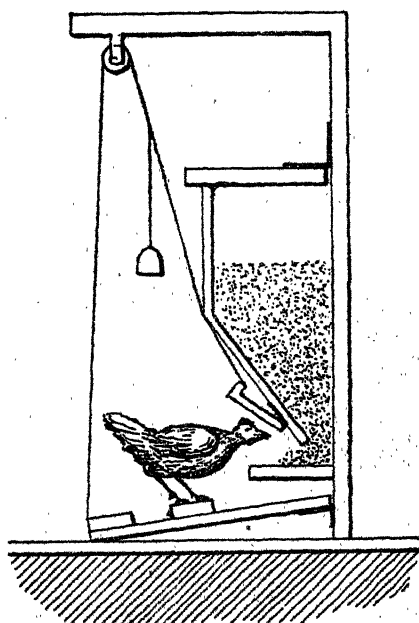


Fig. 2. — Feeding box for poultry. Trap door opened by weight of fowl.

RURAL ECONOMICS.

465 - **Influence of the Distance from the Market on Farming in Fifty Moravian Farms.** — MARESC, H. in *Oesterreichische Agrarzeitung*, Year V, N. 7, pp. 76-89. Vienna, March 7, 1914.

The writer divides the 50 farms under investigation into three groups, the first contains those farms situated within a three mile radius from the

market, the second those between the three and six mile radius and the third those beyond the six mile radius. He then enumerates the possibilities of marketing the vegetable and animal products in these groups, describes the economic conditions of the farms and their labour requirements, both manual and horse, and proceeds to estimate the influence of the distance from markets upon the whole management of the farms.

Distance from markets exerts a great influence on the utilization of the land as is shown by table I:

TABLE I.

Distance from market	Percentage of cultivated acreage				Distribution of total acreage	
	Fields	Gardens	Meadows	Pastures	Cultivated area	Wood
	%	%	%	%	%	%
0 to 3 miles	75	4.1	19	1.9	93.7	6.3
3 to 6 "	82	2.0	13	3.0	86.6	13.4
more than 6 miles. .	63	0.2	29	7.8	69.9	30.1

The relative acreage of cultivated land diminishes with the increase of distance from the market, and still more rapidly does the relative acreage of the gardens decrease, for the carriage of fruit and vegetables is a very difficult matter for small farms. The area in meadow land depends less upon distance than upon soil and water conditions, though their extension in the last group is at least partially due to distance. Pasture and woods increase with distance.

The distribution of capital in the three groups is as follows (Table II):

TABLE II.

Distance from market		Capital invested in :										Working capital			
		land		buildings		dead stock		live stock		crops		total			
		per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital	per acre of cultivated area	per cent of total capital		
		£ s d		£ s d		£ s d		£ s d		£ s d		£ s d		£ s d	
0 to 3 miles .		31 24	58.9	11 18 6	22.7	2 18 0	5.4	5 18 7	11.2	1 0 7	1.8	52 10 6	4 1 0	13	
3 to 6 miles .		22 16 7	59.1	8 5 3	21.4	1 18 2	4.4	4 14 9	12.7	18 11	2.4	38 13 6	4 18 10	13.1	
more than 6 miles. . .		15 7 9	44.4	11 5 4	29.9	2 18 4	7.7	6 5 1 0	16.7	9 5	1.3	35 3 0 5	4 7	23	

The value of the land diminishes considerably with the distance from the market while the value of buildings do not appear to be influenced dir-

ectly. Distance from markets has a more visible effect upon the capital invested in crops, for fruit trees are not planted to any great extent at a distance from markets — the capital invested in fruit trees is between 4s 6d to 9s 9d per acre up to the six mile radius, and beyond, only 1s 8d. The capital invested in live stock is also notably affected: from £6 5s 10d in the first group it sinks to £4 14s 9d in the second and rises again in the third to £6 5s 10d; of these sums the value of draught animals is £1 4s 3d per acre or 20 per cent. in the first group and £1 9s 4d or 31 per cent. and £1 4s 5d or 27 per cent. in the second and third. The capital invested in draught animals thus increases regularly with the distance, while the value of the productive stock which is £4 13s 9d per acre in the first group sinks in the second to £3 5s 5d and rises again in the third to £4 11s 5d owing to the greater production of fodder in distant farms.

The amount of dead stock diminishes from the first to the second group by about one third as, with the less intensive style of farming, machines are not so largely used. At distances beyond six miles the necessity of transport material is more felt and causes an increase of the dead stock. The working capital increases with the distance from the market; this is due to the fact that much of the grain is fed to young live stock, thus retarding the turnover of the capital.

The influence of distance on the labour required in the three groups is shown by the following table which gives the number of available days' work per acre of cultivated area:

0 to 3 miles	51 man days	18 horse days
3 to 6 "	43 " "	15 " "
more than 6 miles	39 " "	23 " "

The draught animals diminish with the increased distance from their market owing to the less intensive style of farming and to the lower number of brood mares kept. At greater distances more horses are required on account of the increased transport. The number of man days diminishes regularly with the increase of distance owing to the decrease of hoed crops and of cereals and the increase of forage plants and pulse.

The proportion of the various crops on the cultivated land is the following:

	up to 3 miles %	beyond 3 miles %
Winter cereals	33.3	23
Spring "	33.3	33
Clover	16.7	22
Hoed crops	16.2	11
Pulse	—	11

As for live stock, the raising of young animals increases with distance: the live weight of young animals is 54.4 lbs per acre of cultivated land in the first group, 56.2 in the second and 75.8 in the third. On the other hand the breeding of foals diminishes as the distance increases and ceases altogether at six miles, the live weight of foals being only 6.2 lbs per acre of

cultivated land up to three miles, 4.5 lbs up to six miles and nil beyond six miles.

Table III gives a summary of the variations of the live stock per acre of the cultivated area according to the distance from the market :

TABLE III.

Distance from market	Live weight of total live stock lbs.	Percentage of		Live weight of cattle		Percentage			Live weight of pigs		Live weight of small animals, mostly poultry	
		Stock for draught purposes	Other stock	lbs	Per cent of total live stock	Steers	Cows	Calves	lbs	Per cent of total live stock	lbs	Per cent of total live stock
0 to 3 miles . .	332	17	83	245	74	5	79.5	15.5	23	6	3.12	1
3 to 6 miles. . .	305	18.3	81.7	205	67	5	76	19	17.8	7	1.34	3
more than 6 miles	327	23	77	239	73	5	64	31	10.7	3.8	1.34	0.2

The number of draught animals increases with the distance from the market and that of productive animals diminishes. The number of steers is not influenced by distance, while the number of cows diminishes and the breeding of young animals increases. Pig-keeping diminishes with the distance both absolutely and relatively to the live weight of the total live stock. Poultry also diminishes with the increase of distance.

Table IV shows the effect of distance upon the value of the agricultural produce marketed per acre of cultivated land :

TABLE IV.

Distance from market	Total value	Consisting of:				Value of the animal products							
		plant products		animal products		Cattle		Horses		Pigs		Poultry	
		£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent	£ s d	per cent
0 to 3 miles . .	4 48	10 11	24.1	3 39	75.9	2 15 2	87.8	2 8	3	4 11	7.7	1 0	1.5
3 to 6 miles. . .	3 19 7	18 11	24.5	3 09	75.5	2 9 7	80.8	1 3	2	8 7	14.2	1 10	3.0
more than 6 miles . . .	1 8 1	5 7	11.0	1 13 7	89.0	1 7 5	82.8	—	—	5 8	17.2	—	—

The receipts per acre of the farms diminish with the increase of the distance from the market, the relative importance of live stock increases, while the absolute value of the animal products diminishes as does that of the vegetable products. By far the greatest proportion of live stock consists of cattle ; the sale of foals is relatively low.

The receipts from pig raising increase with the distance while those from poultry keeping increase at first and then cease altogether at a distance of six miles.

466 - **Types of Agricultural Holdings in Northern Tripoli.** — From the « *Relazione della Commissione per lo studio agrologico della Tripolitania* ». Rome, Ministero delle Colonie, 1913.

The various systems of cultivation existing in Northern Tripoli give rise to different forms of holdings which may be grouped into three main classes :

1. *Irrigated holding or garden* (Sánia) ;
2. *Enclosed mixed plantation* (Genán) ;
3. *Plantations of various sizes.*

1. The *Garden* may be looked upon as the constituent element of the oasis, and is the type of holding where irrigated crops are grown together with certain trees such as palms. It possesses certain characteristics :

a) is hardly ever isolated, but usually forms part of a nucleus of cultivated land (oasis) ;

b) is enclosed and independant, though in the poorer and less well cultivated regions, it frequently has a right of way across it ;

c) is provided with its own well for irrigation purposes which does not prevent the use of natural overflow after rain or of dry land methods of cultivation where such are suitable ;

d) constitutes in all cases a well defined estate unit.

2. The *Enclosed mixed plantation* differs from the garden both technically and economically. The enclosed portion alone hardly ever constitutes a separate estate unit, but is almost always only part of a holding. In other words there is normally adjoining the enclosed plantation a piece of land of varying size which is used for grazing and for growing cereals. This land, further, is frequently used as "*mésqa*" (irrigable land) because in many cases the holding is situated in an undulating district and gets the benefit of the natural overflow after rain. The holding too is almost always isolated never forming part of an oasis. This form of holding, thus consisting of two parts, one for grazing and cereals and the other an enclosed plantation, possesses certain technical characteristics as follows:

a) The enclosure round the inner part of the holding is necessary to exclude the live stock which graze in the outer portion, and usually consists of low *tábia* on the top of which are planted live or dead spinous plants, principally *Calicotoma intermedia*. Prickly pear are no longer used for this purpose as the crops on the inside are less delicate and consequently no longer require such an efficient wind break ; occasionally prickly pears are used as a hedge, grown espalier fashion just inside the enclosure and against the *tábia*, or they may be replaced even in this position by fennel.

b) The boundary of the whole holding is usually marked by a line of *Scilla maritima*, or by low earthen banks, or by long stones set up vertically in the soil.

c) Plantations of trees other than palms are characteristic of dry soils, palms being only found in the moister positions or as isolated specimens. Olives more especially, and figs, vines, almonds and carobs, are the most usual plants with apricots, pomegranates and pears in the more favoured localities.

d) Trees are planted very thickly in the moister positions.

e) Where more intensive culture is carried out herbaceous plants are excluded or reduced to a few vegetables. In the less fertile tracts barley is grown in the bare patches between the trees.

f) Usually there is no living house on the holding, especially if the latter is at all near to a residential centre. Where the living house exists on the holding, it is always situated on the external grazing land, but the more usual thing is for cultivators to camp out on their holding during the tillage and harvest season.

g) Sometimes caves are dug out to afford protection to man and beast from both storms and burning sunshine. Such caves are rare in the Homs district, rather more frequent in Gefara, Mselláta and Tarhuna, and normal in the Jebel Garián.

h) Usually there is no well, but as the land is undulating, there is generally a cistern by the side of which is placed the oil extracting mill; only on the more important estates do they use presses for this purpose, the presses in this case being set up in caves.

j) The size of these holdings is very variable; mixed plantations under intensive culture usually only run to a few hundred square yards; olive groves and vineyards are usually larger, extending on an average to about $1\frac{1}{2}$ acres; holdings of Europeans in the neighbourhood of Homs are much larger still, varying from $12\frac{1}{2}$ to 17 acres, while those on the Steppe of the Mescia of Tripoli will even attain 75 acres in extent.

3. *Plantations* are chiefly found in hilly districts such as Mselláta and Garián, and possess the following characteristics:

a) Their size runs into a few score of acres, being usually larger in M'sell than in Garián.

b) They usually consist of olives and figs generally underplanted with barley.

c) The trees are usually planted in rows at wide distances apart so that underplanting may be practised.

d) The plantations are used for pasturing live stock unless they consist of pure fig plantations, consequently they are not enclosed and boundaries are marked by lines of *Scilla* or by earthen banks.

e) The holdings have no well, cistern, or living house.

f) They have no apparatus for oil extraction on the spot, the olives being taken to the villages to be crushed.

The cost of establishing holdings of type 1 and 2 is estimated below. The figures refer to a non-native cultivator and are only very approximate:

I. *Irrigated holding (1.5 hectares).*

	lire	lire	lire
	—	—	—
I. <i>Value of land</i> (300 lire p. ha)			450
II. <i>Improvements :</i>			
1. Sinking well (13 yds. deep)	600		
2. Irrigation canals	400		
3. Pumping machinery	600		
	—		
		1 600	
4. Fencing or enclosing		750	
5. Buildings		2 500	
6. Tillage (80 day's work)		120	
7. Planting :			
175 palms	450		
45 citrus trees	170		
36 apricots	100		
36 mulberry and other fruit trees	75		
	—	795	
		—	5 763
III. <i>Working capital.</i>			
1. Live stock :			
4 working cows	900		
2 pack animals	600		
	—	1 500	
2. Dead stock		350	
3. Furnishing the house		300	
4. Running expenses, seeds, manure etc.		500	
		—	2 650
			2 650
			—
Total			8 863

2. *Enclosed mixed plantation.*

Two examples are given of this type of holding, one on a thin and rather arid steppe soil which represents poor but not the worst conditions, and one a relatively fertile and moist soil representing more favourable conditions. In the second case it would be possible to cultivate intercalary crops and to raise cattle on the holding over and above the main plantation crops while in the first case this would not be possible. In both cases each holding should accomodate three families of agriculturists, other labour required being provided by natives.

*Example A. — On a thin Steppe (200 hectares).*1. *Distribution of surface.*

	ha.
Olives	60
Vines	1
Figs	1
Almonds	2
Prickly pear and others	35
Fallow	60
Barley	60
Buildings, roads etc.	1.5
	<hr/> 200.0

2. *Distribution of capital :*

	lire	lire
Price of land (50 lire per ha.)		10 000
Living houses		9 000
Buildings		14 000
Wells, sinking etc.		1 800
Roads		1 000
Plantations :		
Vines, expenses for four years	1 200	
Olives (compensated by barley crop)		
Figs " " " "		
Almonds " " " "		
Prickly pear and others	700	
		<hr/> 2 000
20 Working animals		6 400
Dead stock, including oil extraction apparatus		12 720
Working capital :		
Food for stock	5 500	
Depreciation and repairs	1 200	
Seeds	1 000	
Labour	6 300	
General expenses	500	
		<hr/> 14 500
Establishment expenses		980
		<hr/>
Total		72 100
per ha.		362

*Example B. — On a richer Steppe (300 hectares).**1. Distribution of surface :*

	ha.
Olives	55
Vines	3
Almonds	10
Figs	2
Prickly pear and others	8
Fallow	55
Forrage crops	55
Barley	107
Hoed crops	3
Buildings, roads, etc.	2
	<hr/> 300

2. Distribution of Capital.

	lire	lire
	<hr/>	<hr/>
Price of land		30 000
Living houses		9 000
Buildings		25 000
Well		1 800
Roads		2 000
Plantations :		
Vines	1 300	
Prickly pear and others	1 600	
	<hr/>	2 900
20 Working animals		9 600
25 other		6 250
Dead stock including oil extraction apparatus		16 680
Working capital :		
Food for stock	8 250	
Depreciation and repairs	1 800	
Seeds	28 000	
Labour	8 100	
General expenses	700	
		21 650
Establishment expenses		1 220
		<hr/>
Total		126 600
per ha.		422

Lastly, estimated expenses and returns in the two above examples of mixed plantations are given in Table I:

TABLE I.

	Example A.						Example B.					
	Gross returns			Expenses			Gross returns			Expenses		
	Production		Value		Profit		Production		Value		Profit	
	per ha.	total	kg.	litre	per kg.	total	per ha.	total	kg.	per kg.	total	litre
	kg.	kg.	kg.	litre	litre	litre	kg.	kg.	kg.	litre	litre	litre
Olives, oil	6	9 720	0.80	7 760	4 400	3 360	10	14 850	0.80	11 880	6 780	5 100
Vines	3	15 000	0.10	1 500	1 000	500	6	30 000	0.10	3 000	1 700	1 300
Almonds,	15	2 100	0.30	630	490	140	20	10 000	0.30	3 000	2 000	1 000
Figs	15	7 500	0.10	750	500	250	30	4 200	0.10	420	200	220
Intercalary crops	—	—	—	400	150	250	—	—	—	1 200	450	750
Barley	700	42 000	0.20	8 400	7 438	942	900	96 300	0.20	19 260	10 100	8 560
Hoed crops	—	—	—	—	—	—	—	—	—	1 500	900	600
Live stock	—	—	—	—	—	—	—	27 head	320	8 640	6 380	2 260
Total	—	—	—	19 440	13 998	5 442	—	—	—	48 900	29 110	19 790
Average per ha.	—	—	—	97.20	69.99	27.21	—	—	—	163.00	97.03	65.97

467 - The Recent Valuation of Land other than Building Land in France. — HITIER H. in *Bulletin de la Société d'Encouragement pour l'industrie nationale*. Year 113, No. 2, pp. 229-241. Paris, February 1914.

According to the data collected for the new land valuation which was commenced in 1908 and is now finished, the total extent of land subject to land-tax is 125 145 373 acres.

It consist of the following groups. (Table I) :

TABLE I.

	Area, acres	Percentage of total area
Arable land	58 626 815	46.54
Forest, Alders, Osiers, etc.	24 011 371	19.06
Heaths, swamps, waste land, etc.	17 805 805	14.13
Natural meadows and pastures	17 081 429	13.56
Vineyards	3 704 283	2.94
Orchards	1 836 858	1.46
Gardens (market and flower) nurseries, etc.	980 724	0.78
Other uncultivated areas water courses, lakes, railways, etc.	1 098 088	0.87
Areas under buildings	125 145 373 836 711	99.34 0.66
Total area	125 982 084	100

When comparing the results of this new valuation with those of the years 1851 and 1879 it appears that the arable area increased from 1851 to 1879 by about 988 400 acres, after which it decreased to such an extent that in 1908 it was 2 526 877 acres less than in 1851. On the other hand the area under meadows and pastures has increased 4 942 180 acres during the same time. The acreage of vineyards is 1 640 240 acres less than in the year 1851, whilst the private forest land has increased from 18 960 073 acres in 1851 to 20 750 066 acres in 1879 and to 21 506 549 acres in 1908.

The total capital value of all land other than building land is estimated at £2 489 619 017 and its rental value at £81 553 946. The corresponding average values per acre are £19 17s 10d and 13s 2d. Similar values in 1851, 1879 and 1908 are given in Table II :

TABLE II.

	Value of total rental	Value of total capital	Rental per acre	Value per acre
	£	£	s d	£ s d
1851	72 325 336	2 426 022 679	12 2 ¼	20 9 5 ½
1879	104 889 004	3 631 121 087	17 0	29 7 2 ¾
1908	81 553 946	2 489 619 017	13 1 ¾	19 17 10 ¾

Both capital value and rent increased considerably from 1851 to 1879 after which they sank nearly to the same level as in 1851, the value per acre being somewhat lower than in 1851 and the rental per acre a little higher.

The value of land per acre varies considerably both absolutely and relatively, according to the kind of crops carried (Table III) :

TABLE III. — *Value per acre.*

Year	Arable land				Meadow and pastures				Forest				Vineyards									
	Average rent		Average value		Average rent		Average value		Average rent		Average value		Average rent		Average value							
	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d					
1851	13	6	23	14	7	1	3	5	36	3	11	6	5	10	6	0	1	2	2	33	3	3
1879	18	3	35	5	0	1	11	2	47	10	2	7	5	11	19	1	2	1	9	47	12	5
1908	15	9	24	0	0	1	0	10	30	2	8	5	5	9	3	10	1	4	5	32	14	4

The considerable diminution in value (33 per cent.) of landed property in France since 1879 is in no wise due to a decrease of the gross returns from agricultural produce but only to the reduction of net returns ; for, while the gross returns in France amounted to £706 329 120 in 1892 and rose to £848 308 608 in 1911, thus increasing in 20 years by £141 979 488, the total net returns of agriculture in France sank from £47 498 304 in 1882 to £31 718 400 in 1892 and to £30 568 808 in 1911, diminishing by £16 929 696 during the last 30 years. The change has been caused by increased financial burthens laid upon agriculture together with constantly increasing expenses.

Though the average value of land has diminished so considerably for the whole of France, it has nevertheless continuously increased in some parts of the country. In this respect the contrast is most striking between the east and west of France. While in Brittany the average rent per acre has risen from 9s 4d in 1851 to 15s 9d in 1879 and 16s 4d in 1911, in the eastern departements Meuse, Meurthe-et-Moselle, Marne, Haute Marne and Haute Laône it rose from 10s 3d in 1851 to 13s 6d in 1879 and then fell again to 9s 4d in 1908. The difference is explained, according to the writer, by the fact that in the west, in Brittany, agriculture has made great progress owing to the still abundant agricultural labour, to the recently improved means of communication, to the use of artificials on poor heath lands and so forth, while in the east the lack of labour is always more keenly felt and the returns from the vineyards, one of the chief sources of revenue, are constantly diminishing. In Brittany 226 978 agricultural labourers are available for 6 733 389 acres, (3.24 per 100 acres), while in the east there are only 66 843 for 7 708 543 acres (or 0.81 per 100 acres).

468 - Cost of Production, Marketing and Exporting Wheat in Canada. — *Synopsis of the Report of the Saskatchewan Royal Commission on Grain Markets*, pp. 1-3. Regina, Saskatchewan, January 1914.

In their report into the ways and means for bettering the position of Saskatchewan grain on the European markets, the Saskatchewan Royal Commission on Grain Markets gives the costs of production, marketing and exporting wheat as follows:

The average cost of producing wheat amounts to 55 cents per bushel on the farm, and 62 cents when placed on a car at a country point.

Data is presented to show that the cost of production has increased 12.15 per cent. since 1909, while the price of wheat paid to the farmer has constantly diminished. The prices are as follows:

1909	81 ¹ / ₅	cents per bushel
1910	76 ¹ / ₆	" "
1911	74 ¹ / ₅	" "
1912	69	" "
1913	66 ¹ / ₈	" "

The total cost of marketing the wheat for export has increased since 1909 as is shown by the following figures which refer to 1000 bushels of wheat from the shipping point to the European port:

	1909	1913
	\$	\$
1) For receiving, weighing, elevating, cleaning, spouting, insuring against fire, storing and loading into car.	17.50	17.50
2) Railway carriage:		
a) to Winnipeg, on average	120.00	120.00
b) from a lake port to Montreal	42.50	42.50
3) For sampling and inspecting at Winnipeg, for cargo inspection and weighing out at Fort William . .	1.60	1.60
4) For selling wheat on Winnipeg grain Exchange . .	10.00	10.00
5) For the exporter, say	10.00	5.00
6) To the terminal elevator owner, for receiving, elevating etc.	7.50	7.50
7) Interest and exchange on money supplied by bank .	14.40	16.40
8) Lake Steamship Co. for carriage	10.00	20.00
9) To Transfer Elevator Co. for elevation from vessel to cars and transfer to ocean vessel	11.50	11.50
10) To Ocean Steamship Co., freight	40.00	75.00
11) Marine Insurance	9.60	9.60
12) Sundry charges	10.00	10.00
	<hr/> \$ 304.60	<hr/> \$ 346.60

469 - The Cost of Raising a Dairy Cow. — BENNET, C. M. and COOPER, M. O. in *Bulletin of the U. S. Department of Agriculture*, No. 49, pp. 1-23. Washington, January 14, 1914.

The writers availed themselves of carefully kept accounts of a farm in Wisconsin covering a period of five years, in order to determine the cost of

raising a heifer from the time of its birth to the dropping of its first calf and entry into the dairy herd.

The heifers kept on this farm are Jerseys. During the five years (1907-1912) over which the calculations extend 73 heifers were raised. September 1st was taken as the beginning of the year, for by that time the greater number of the cows in the farm had calved. When calculating the cost during individual months, in order to avoid any error caused by the addition of a new calf or the withdrawal of another from a group, the average number of head in the various groups is calculated on the basis of the feed days.

The cost of production is illustrated by complete records of one group of calves from birth in September 1909, up to the time they entered the herd in September 1911. The quantity and cost of the food consumed, and the amount and cost of manual and horse labour are given in Table I.

TABLE I.

Item of cost	1st year		2nd year		3rd year	
	Actual cost	Per cent.	Actual cost	Per cent.	Actual cost	Per cent.
Food	\$ 24.58	68.4	\$ 16.11	62.8	\$ 40.69	65.6
Labour	5.14	14.3	2.86	11.0	8.00	12.9
Interest	1.12	3.1	2.53	9.9	3.65	5.9
Buildings	1.57	4.4	0.81	3.1	2.38	3.8
Equipment	0.55	1.5	—	—	0.55	0.9
Bedding	1.00	2.8	2.00	7.8	3.00	4.8
Miscellaneous expenses . . .	0.28	0.8	0.16	0.6	0.44	0.7
General expenses	1.71	4.7	1.22	4.8	2.93	4.7
Losses by death and discarding	—	—	—	—	0.42	0.7
Total . . .	35.95	100	25.69	100	62.06	100
Credit, manure	3.00	—	5.00	—	8.00	—
Total cost of raising	32.95	—	20.69	—	54.06	—
Initial value of calf	7.00	—	—	—	7.00	—
Total net cost . . .	39.95	—	20.69	—	61.06	—

After some explanations as to the way the various items of the above table have been calculated the writers compare (in Table II) the cost of raising heifers belonging to different groups (1908, 1909 and 1910) for two years.

The average net cost of a dairy heifer two years old is \$ 61.41, which consists of its initial value \$ 7.04, food \$ 40.83, labour \$ 7.81 and other costs as per table I \$ 13.73 making a total of \$ 69.41 minus \$ 8 for manure. The most important item of cost is the food, which amounts to 65.5 per cent.

TABLE II.

Item	1908 group		1909 group		1910 group	
	Actual cost	Per cent.	Actual cost	Per cent.	Actual cost	Per cent.
Whole milk	\$ 4.74	12.1	\$ 5.28	12.8	\$ 7.36	17.4
Skim milk	7.89	20.0	6.33	15.6	6.91	16.3
Roughage	16.60	42.1	16.81	41.3	18.40	43.6
Grain	6.44	16.3	6.94	17.0	4.45	10.5
Pasture	3.73	9.5	5.33	13.3	5.19	12.2
Total cost of food . . .	39.49	100.0	40.69	100.0	42.40	100.0
Food	39.40	65.5	40.69	65.5	42.40	65.4
Labour	7.86	13.0	8.00	12.9	7.56	11.6
Other costs	12.91	21.5	13.37	21.6	14.91	23.0
All costs	60.17	100.0	62.06	100.0	64.87	100.0
Credit, manure	8.00	—	8.00	—	8.00	—
Cost of raising heifer	52.17	—	54.06	—	56.87	—
Initial value	6.30	—	7.00	—	7.83	—
Total net cost of production . .	58.47	—	61.06	—	64.70	—

The manure practically offsets the cost of labour, and may therefore be omitted in the calculations; this is all the more worthy of note inasmuch as the accurate calculation of the cost of labour is the most difficult part of the whole work.

AGRICULTURAL INDUSTRIES.

470—On the Schardinger and Other Reactions of the Ferments of Goats' Milk.
— WEDEMANN W. in *Biochemische Zeitschrift*, Vol. 60, No. 4, pp. 330-343. Berlin
March 13, 1914.

DAIRYING.

The following results have been obtained from a biological study of the milk of 16 goats of different origin and in different stages of lactation:

1) A solution of methylene blue in formaldehyde (Schardinger) is not discoloured by either fresh or stale milk or by cream. This is in accordance with results obtained by other investigators.

2) A solution of hydrogen peroxide (1 per cent.) is only slightly decomposed by fresh milk, showing that it only contains a very small amount of catalase.

3) Rothenfusser's and Storch's reagents and benzidin (di-amino benzol) are decomposed by fresh goat's milk as well as by cow's milk.

4) The quantity of Schardinger's enzyme is constant throughout the lactation period whether the goats are rearing their young or otherwise. Infection with contagious abortion does not affect the milk in this respect.

471 - **Caseinogen and Casein** (1). — GEAKE, A. (University of Bristol) in *The Biochemical Journal*, Vol. VII, No. 1, pp. 30-37. Cambridge, February 1914.

With the idea of establishing the chemical identity or dissimilarity of casein and caseinogen, the writer carried out a series of experiments to determine the composition of the two compounds. The carbon, hydrogen, nitrogen, sulphur, and phosphorus content was estimated, and the Hausmann numbers (*i. e.* proportion of the total nitrogen present as ammoniacal nitrogen, melanin nitrogen, diamino nitrogen, monamino nitrogen) were determined for both casein and caseinogen with the result that no appreciable differences could be detected between the two compounds.

472 - **The Biological Examination of Honey.** — THÖNI, J. in *Schweizerische Bienen-Zeitung*, Year 37, No. 1, pp. 23-31. Aarau, January 1914.

The progress achieved in the manufacture of artificial honey, which is now very similar to real honey in its physical and chemical properties, has led to the adoption of new methods of examining honey based on biological instead of chemical and physical characters. At present two such methods are in use by means of which any adulteration is immediately detected. They are the diastase reaction and the quantitative precipitin reaction.

The diastase reaction is based on the fact that honey contains a diastatic ferment secreted by the bee which, in contact with soluble starch, is capable of transforming the latter into sugar. The precipitin reaction is based upon the fact that honey contains a special protein secreted by the bee which when inoculated into rabbits, causes the formation of antibodies in the blood serum; these antibodies when mixed with the honey under examination yield a precipitate. The quantity of this precipitate indicates the kind and amount of the adulteration. Instead of using honey for inoculating the rabbits, extracts from the bodies of bees can be used or bees bread from queen cells and other cells. The two latter are especially suitable on account of their high content of bee protein, and produce a serum with a high content of antibodies. As the amount of precipitate may vary considerably for the same solution of honey according to the bee protein used, tests should always include a control which consists of some absolutely genuine bee honey as similar as possible to the honey under examination in appearance and in consistency.

The details of both methods of analysis are the following:

Diastase reaction. — 10 cc. of the honey to be examined (concentration of the solution, 1:2) are mixed in a test tube with 1 cc. of a 1 per cent.

(1) The writer refers to "the work of VAN SLYKE and BOSWORTH (see No. 283, *B. March*, 1914) but his nomenclature differs from theirs:

"Caseinogen" in the present paper being equivalent to "casein" in the former paper and "casein" in the present paper being equivalent to "paracasein" in the former paper.

solution of soluble starch and kept for an hour in a water bath at 45° C. (113° F.). If diastase is present in the solution of honey, the starch during this time will be converted into sugar. This is ascertained by removing the test tube from the water bath, adding to its contents 1 cc. of solution of potassium iodide, shaking it and examining the intensity of colour. If all the starch is transformed into sugar, the colour of the mixture is only very slightly darker than that of the original solution of honey. If no starch has been transformed the colour of the solution is deep black blue. Examined by this method most genuine centrifugated honey gives a light olive green to a light brown colour. Boiled solutions of honey assume a deep blue to black blue colour because they do not contain any more active diastase. Honey that has been heated shows, according to the degree and duration of the heating, colours varying from red brown, brownish, olive, light bluish green and blue green to deep blue. Artificial honeys show always deep black blue, because they naturally do not contain any diastase. Heat appears to exert an action on the result of the diastase reaction only above 90° C.

Quantitative precipitin reaction. — Three solutions of each kind of honey to be examined are prepared containing 10 per cent., 2 per cent. and 1 per cent. respectively, and 1 cc. of each is used. The bee protein serum is added in definite proportions (0.5 cc. of serum to the 10 per cent. solution, 0.3 cc. to the 2 per cent. solution and 0.2 cc. to the 1 per cent. solution) with one drop of toluol in order to suppress any development of bacteria. The whole is then left for 5 hours at 35° C. (95° F.) Special glass tubes (millimeters) are used for the reception of the above mixtures, the lower part of which are narrowed and graduated so as to allow of an accurate determination of the amount of the precipitate. After standing 5 hours at 35° C., by which time the formation of the precipitate may be regarded as complete, the test tubes are centrifugated for 5 minutes, thus forcing the precipitate into the narrowed portion of the tube where it can be read off. In general there is no difficulty in judging the results of the examination according to this method. If the amount of precipitate obtained is equal or larger than that obtained from the standard or control, then the sample may be considered genuine, while if the quantity of precipitate is considerably less than that of the control then the sample, is a mixture of genuine and artificial honey or consists of partially denatured honey. It is not possible however to know whether the sample has been mixed or denatured. The total absence of precipitate or the presence a very small quantity only in the 10 per cent. solution indicates the presence of artificial honey or of honeys the proteins of which have been destroyed. Wild honeys in general give smaller precipitates than flower honeys, while in the case of honeys produced by pure sugar feeding, the quantity of precipitate is about one half of that of genuine bee honey. Heating honey for one hour at the temperature of boiling water causes the precipitate to fail completely.

MILLING
INDUSTRY.

473 - Preliminary Investigation into the Variation in the Physical Composition of Wheat Milling Offals. — CRANFIELD, H. T. in the *Journal of Agricultural Science*. Vol. VI, Part I, pp. 102-110. Cambridge, January 1914.

This investigation was carried out in the hope of devising a simple method of classifying the different grades of wheat offal that would form a suitable basis for market standardisation. Some 100 samples were collected from various parts of the country and arranged into ten groups according to their physical appearance. Determinations of the percentage of moisture, density and proportion of flour were made so as to obtain some idea of the value of classifying according to external appearance.

It was found that the percentage of moisture varied from 11.37 to 16.21. Samples containing more than 15 per cent. are liable to turn mouldy very quickly. The most important constituents are the husk and flour and these differ widely in their densities, so that the density of a sample is an indication of the proportions of these two constituents.

Density determination were made as follows: about 20 gm. of the offal were dried at 100° C. for 5 hours and cooled in a desiccator. Fifteen grams were weighed and placed in a 100 cc. graduated cylinder; the settling was effected by jolting to constant volume before and after weighting with a 100 gm. lead weight made to fit the cylinder exactly and having a stout rubber washer glued to the bottom. Abnormal results were obtained with samples containing a large quantity of semolina and samples of small bran rolled to give the appearance of broad bran.

The proportion of flour was estimated in terms of the percentage starch present which was determined as follows: 5 gm. of the offal were placed in a bag of fine silk gauze and kneaded in successive quantities of hard tap water until the final liquid gave no reaction with iodine. The washings were made up to 500 cc., and 50 cc. of the well shaken milky liquid were pipetted into a Gerber test tube and centrifuged by hand for 5 minutes. The clear supernatant liquid free from starch was decanted off and more water added, the starch deposit stirred up and the tube again centrifuged. This process was repeated with ordinary alcohol and finally with absolute alcohol. The deposit of starch was then dried at 100° C. and weighed. With fine offals the crude starch obtained in this way contained a small and fairly constant percentage of protein matter (about 3 per cent.), but with bran and coarse offal the percentage of protein averaged 13.5 per cent.

The chief impurities in wheat offals are weed seeds and oat husks. More rarely are found barley husk, rice husk, coffee bean husk and tapioca.

The writer suggests that the following determinations should be made in grading milling offals: percentage of moisture, apparent density, percentage of starch (or flour), purity; and that a series of grades should be arranged in cooperation with the millers, with stated limits for these determinations.

474 - **A New Process of Preparing Potatoes for Acid Ensilage with Pure Cultures of Lactic Bacteria.** — FOTH, G. in *Zeitschrift für Spiritusindustrie*, Year XXXVII, No. 8, p. 103. Berlin, February 1914.

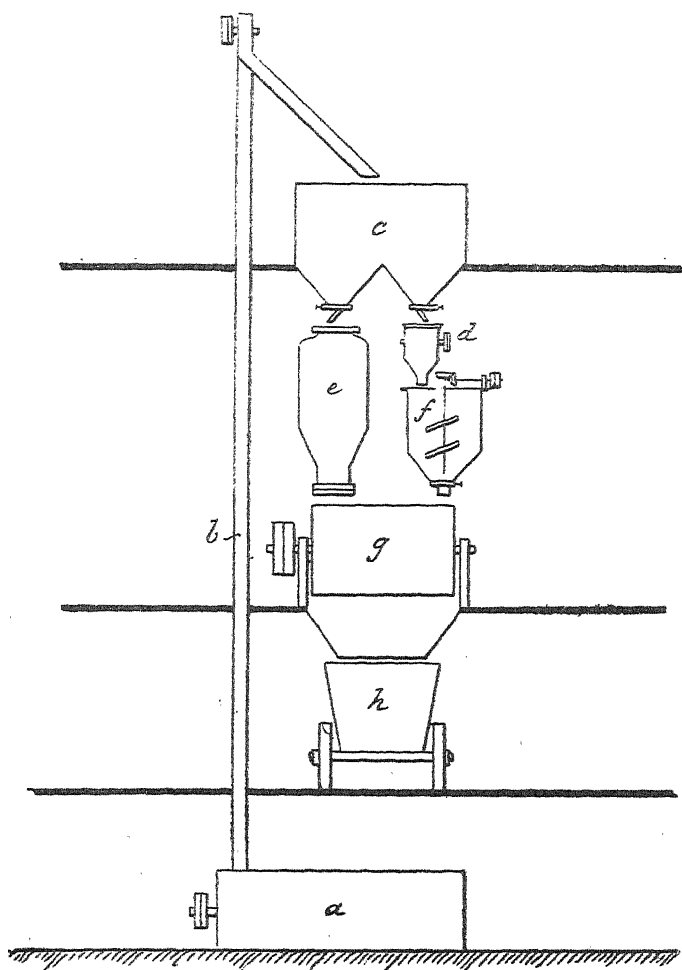
Numerous experiments have shown that, in the preparation of acid silage, considerable losses of nutritive matter can be avoided by the use of pure cultures of lactic ferments, a more conservable and hygienic product being obtained. Attempts have also been made to apply this principle to practical agriculture. In doing so, two conditions must be fulfilled, viz : a) the lactic ferment must be uniformly distributed throughout the mass ; and b) a suitable temperature must be maintained. These conditions may be fulfilled by grating the potatoes in two separate lots one of which is steamed. The writer describes the process of obtaining a uniform mass consisting of cold grated potatoes and steamed potato paste in a special apparatus.

The general plan of this apparatus is shown in the accompanying diagram : the washed potatoes are transferred from the washing trough (a) to the distributor (c) by means of an elevator. One lot are then fed to the steam heater (e) and from this to the pulper (g) by means of an Archimedes' screw ; or through several small heaters which are charged alternately and discharged into the pulper (g). The second lot of potatoes are passed through the grater (d) into the vat (f) fitted with a rapid stirrer from which they pass into the mixer (g), which is similar to those used for mixing manures or for kneading the dough in bread making. This mixer is placed at height of about 8 feet from the ground so that a waggon may be conveniently placed below to receive the fermented ensilage.

The apparatus works as follows : to produce 30 cwts of ensilage by the warm fermentation method, 15 cwts of potatoes are heated by steam and 15 cwts are grated in the cold. Both lots are passed into the mixer and the temperature of the mixture becomes equal to the average of the temperatures of the pulp before mixing, i. e. about 55° C. The lactic ferment is added and thoroughly mixed with the pulp. Cold fermentations are obtained by increasing the quantity of raw grated potatoes and decreasing the quantity of hot potato mash. When the kneading is complete and the ferment evenly distributed, the mass is discharged into the waggon placed below. From four to five kneadings can be carried out in one hour.

Other hashed forage such as mangel leaves and potato haulm may be added to acidify the steamed potatoes. Where available, brewer's grains may also be substituted for the grated potatoes.

The writer believes that the use of this plant is not only technically possible but also economically sound, since the steam required for the washing, elevating and mixing machines can be used for heating the potato pulp.



- a) washing trough.
- b) elevator.
- c) distributor.
- d) grater.
- e) steam heater
- f) vat with stirrer.
- g) pulper.
- h) waggou.

- 475 - **The Utilisation of the Proteins of Cotton Seed by Man.** — RATHER, J. B. (Texas Experiment Station) in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 3, pp. 584-586. Washington, D. C., March 1914.

Experiments on the digestibility of cotton seed meal and cotton seed flour by man have been carried out in two trials. Three men were used in one trial and two in the other. The cotton seed was fed in a simple diet of milk, butter and bread made of corn meal and of the cotton seed meal or flour to be tested, and it was compared with a canned chicken product. The trials lasted two days each, charcoal being used as indicator in the faeces.

The sifted cotton seed meal contained 46.33 per cent. protein and the flour contained 50.16 per cent. protein, and it was mixed in the bread to the extent of 26 per cent. The utilisation value of the milk in the diet was assumed to be 97 per cent. and that of the cornmeal 85 per cent.

The utilisation value of the cotton seed protein in the meal averaged 77.6 per cent. and in the flour 79.5 per cent. The value of the meat proteins was 96.6 per cent. Thus, taking 78.6 per cent. as the average digestibility value of cotton seed protein, it is equal to that of legumes (78 per cent.), nine tenths that of cereals (85 per cent.) and eight tenths that of meat.

- 476 - **Mechanical Treatment of Oil Palm Fruits.** — KEMMER, W. in *Verhandlungen der Oelrohstoff-Kommission des Kolonial Wirtschaftlichen Komitees*, No. 1, pp. 17-22. Berlin, November 3, 1913.

The fruits of the oil palm are borne in large clusters at the crown resembling huge strawberries, which weigh sometimes as much as 110 lbs. each. The individual fruits are about the size and shape of a pigeon's egg, and they consist of an outer oily pulp and of a hard nut enclosing an oily kernel.

These clusters are knocked down by the natives and kept in the shade until the fruits fall out of their own accord; they are then heated in shallow pans for several hours over a fire, after which they are thrown into an old canoe or any suitable trough and stamped under foot or beaten with clubs until the pulp is separated from the nut. The addition of water hastens the process. The pulp and the oil, already floating on the surface, are collected, and the oil still remaining in the pulp is squeezed out by hand. The oil after being boiled and clarified is ready for sale. The nuts are spread out in the sun to dry, then cracked with a stone, the kernels picked out and packed for sale. It has been calculated that with this system it takes 10 strong negroes 26 days to produce 880 lbs. of oil.

Until lately all the palm oil and kernels exported from the West coast of Africa were prepared by these primitive processes, which extracted only about 7 per cent. of oil from the fruit. After several years of experiments the firm Haake, with the support of the Colonial Economic Committee, succeeded in building in 1907 a machine which was the first step towards the mechanical production of palm oil and kernels. The North West Kamerun Co. was the first to prepare palm oil on Haake's system. Two years later the West African Plantation Co., under the writer's management, adopted the same system, which meanwhile had been improved, and so did a French Company of the Ivory Coast and the Agou Plantation in Togo.

Haake's system is based on the so-called "wet process" as follows: the fruit is cooked in large pans and then freed from the pulp in special machines; the latter is then allowed to stand to drain, after which it is again heated and put under the presses. The palm nuts are cracked in a large centrifugal machine and the kernels separated from the shells by a drum shaped sieve or by brine. With this process 100 lbs of palm fruits yield 15 lbs of oil and 14 lbs of kernels; 4 or 5 tons of fruit can be treated daily by 15 to 20 men.

The quality of the oil is very much the same as that produced by the native process. It contains a high percentage of fatty acids, often above 30 per cent., and can therefore only be used for the manufacture of soap or candles. Some sorts of oils prepared by the natives however, such as the best Lagos oils, were superior to the most carefully made mechanical oils. Of late years palm oil has also been in demand for human food. For this purpose however it must not contain more than 12 per cent. of fatty acids at a maximum. Consequently the firms which have recently taken up the mechanical preparation of palm oil attached great importance to the production of an oil containing a low proportion of fatty acids, and as the intimate mixture of water with the oil during the process of manufacture favours the production of these acids, a new process, the "dry process", was developed. The fruits were pressed without previously mixing them with water. They required repeated pressing in order to extract all the oil. Several firms adopted this system which gives a higher yield of oil and an oil with a lower fatty acid content than the "wet process" though not yet up to the requirements of the edible oil industry.

The various palm oil factories continued to devote their attention to the problem of improving both yield and quality of the oil, and at a conference of German palm oil producers, summoned by the writer in September 1913, it appeared that several firms, amongst which was the Agu Plantation in Togo, had succeeded in producing a palm oil which did not contain more than 8 per cent. of fatty acids.

The Agu process is based upon the native processes which yielded the best oils, and consists essentially of the following operations:

The fruit are no longer separated from each other, thus saving much labour, only the core is cut out. As soon as possible, *i. e.* within 2 hours from being gathered, they are heated up to 100° C. (212° F.) and maintained at this temperature to prevent the formation of fatty acids. They are then thoroughly crushed in a machine so as to break up the cells and render the pressing easier. One pressing only is required, and this is another advantage over the other systems. On the Agu Plantation, 16 and even 17 per cent. of oil have been obtained, and from 10 to 11 per cent. of kernels.

- 477 - **The Respiration of Fruits and Growing Plant Tissues in Certain Gases, with Reference to Ventilation and Fruit Storage.** — HILL, G. R. in the *Cornell University Agricultural Experiment Station, Bulletin* No. 330, pp. 377-407. Ithaca, N. Y., April 1913. — 2. BOODLE L. A. in the *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, No. 1, pp. 11-16. London, February 1914.

I. — The softening of peaches due to the rapid hydrolysis of the pectose in the cell walls and the phenomenon of "ice-scald", or the decay of the tissues beneath the skin of the fruit on storage, suggested experiments to determine the factors influencing the metabolic processes occurring in fruits. The existing literature shows that many katabolic processes due to enzymes occur in plant tissues and that carbon dioxide is produced in the absence of oxygen. Protein decomposition also takes place and alcohol, lactic acid and glycerine, etc., are produced by the action of zymase on suitable carbohydrates.

The first of these experiments deals with the effect of nitrogen and hydrogen on the rate of evolution of carbon dioxide by ripe cherries, blackberries, green peaches, ripe grapes, and germinating wheat. The fruits are placed in respiratory bottles of 250 cc. capacity. The gases were passed through the bottles, dried by means of calcium chloride, and the carbon dioxide collected in potash bulbs. The temperature was controlled to within 0.5° C. by means of an electric thermostat.

The results obtained with the various fruits are as follows:

Ripe cherries. — Respiration in air at 30° C. increased after 60 hours, probably owing to increased production of enzymes. In nitrogen and hydrogen there was a slight decrease in respiration after 36 hours.

Green peaches. — In air there was a steady decline in the production of carbon dioxide during the first 60 hours, after which it remained almost constant. The production of CO_2 was less in both nitrogen and hydrogen and the constant rate was reached earlier (about 40 hours).

Ripe grapes. — Respiration was equally rapid in air, nitrogen and hydrogen, and equal to about half the rate of that of ripe cherries under similar conditions.

Germinating wheat at 25° C. — The respiration of seeds sterilised in formalin was greater than that of seeds sterilised in alcohol. It was much slower in hydrogen and nitrogen than in air.

These results show that in tissues containing actively growing protoplasm, the absence of oxygen results in a marked decrease in the respiratory rate. On the other hand the activity of mature tissue such as the pulp of ripe fruits is unaffected by the absence of oxygen. The rate of anaerobic metabolism in ripe cherries is much greater than that of grapes and green peaches, and since cherries spoil more quickly, there would appear to be a connection between the rate of spoiling of fruit and the rate of respiration.

Experiments were then carried out to test the keeping qualities of fruits in closed jars containing nitrogen, hydrogen, carbon dioxide and air.

Sterilised glass jars of 4 litres capacity were used and small bottles of sulphuric acid and potash were placed in the jars to prevent the accumu-

ation of moisture and carbon dioxide. The apples were sterilised by dipping in 95 per cent. alcohol and rinsing in sterile water. No attempt was made to sterilise the peaches. The jars were sealed except those containing air which were plugged with cotton stoppers, and kept in the laboratory at a temperature between 21° to 23° C. The results were as follows :

Apples. — Of the apples stored in air 2 were almost completely destroyed by brown rot, but the remaining 5 were in good condition and much less sour than at the beginning of the experiment. The apples stored in nitrogen and hydrogen entirely lost their red colour and looked as if they had been half baked in a slow oven. The skin showed small blisters and the flesh was light brown at the surface and white inside, rapidly darkening on exposure to air. The natural flavour was almost entirely gone. Attempts to obtain cultures of organisms from the brown flesh were unsuccessful showing that these effects were the result of anaerobic metabolism of the fruits.

Peaches. — Hard market-ripe peaches were used, 10 being placed in each jar. At the end of seven days, only 3 peaches were free from rot in the jar containing air. These three peaches were in good condition, of a beautiful cream colour, soft, juicy and of excellent flavour. Those stored in nitrogen, hydrogen and carbon dioxide were unchanged in appearance but had acquired a bad flavour and darkened rapidly on exposure. At the end of four weeks, those in nitrogen and hydrogen were mostly brown and soft and had entirely lost their aroma and flavour. Some of them had hard green spots with a decidedly bad flavour. The peaches in carbon dioxide were mostly green and as hard as when placed in the jar four weeks earlier, but they had a bitter nauseating flavour similar to that of the hard green spots of the fruits in nitrogen. When exposed to air they turned brown very rapidly but did not markedly soften.

Further experiments were carried out to determine the effect of the degree of ripeness on the rate of softening of peaches. Fruits were selected at three stages, *viz.* very ripe, market ripe and hard green. They were allowed to remain in the gases for two weeks. The peaches in air retained their qualities and ripened well, but the very ripe fruits and some of the others were attacked by brown rot after a few days. The ripe fruits developed a bad flavour in all three gases, darkened noticeably and had the appearance of peaches that had been badly injured in shipment in refrigerator cars. The hard green fruits remained hard in all of the oxygen-free gases.

The foregoing results show the importance of thorough ventilation of stored fruits. It would appear that ice "scald" of peaches is due to the accumulation of carbon dioxide within the wrappings of the fruits. The question of a suitable wrappers for fruits is therefore worthy of investigation from the stand point of ventilation. The softening of peaches can be prevented by inert gases, but there yet remains to be found a method which does not influence the flavour of the fruits.

2. — The writer commenting on the above results points out that the amount of carbon dioxide produced per hour by 100 gm. of ripe grapes at 30° C. was 5.2 mgm. or 2.9 cc., so that at this rate the grapes would

give off a volume of carbonic acid equal to their own bulk in about 32.6 hours, and ripe cherries would produce this amount in 11.8 hours. Active respiration is accompanied by evolution of heat which accelerates the rate of respiration. Thus, if aeration is insufficient, local heating occurs at "compound interest", and the refrigerating apparatus is unable to cope with the increasing temperature. The following results of an experiment are given by way of illustration.

An insulated storage room of 6000 cubic feet capacity was fitted with a refrigerating machine capable of reducing its temperature to 27° F. (or -3° C.). Six tons of vegetables in boxes were placed in this room in order to store them at 35° F. (2° C.). The initial temperature was 59° F. (15° C.) and after 10 hours' working the machine was not able to reduce it below 50° F. (10° C.). The refrigerator was stopped and in 12 hours the temperature had risen to 59° F. and in 15 hours more it reached 66° F. (19° C.). The outside temperature during this time varied between 45° and 52° F. (7° and 11° C.).

The successful cold storage of fruits and vegetables therefore involves a suitable system of spacing out and packing in order to insure efficient aeration and consequent retarding of the rate of respiration. This may so increase the cost of running expenses as to make the process commercially impossible.

478 - **The Successful Storage of Californian Table Grapes.** — STUBENRAUCH, A. V. and MANN, C. W. in the *Bulletin of the U. S. Department of Agriculture, Contributions from the Bureau of Plant Industry*, No. 35, pp. 1-31. Washington, D. C., December 13, 1913.

Experiments have been conducted by the Bureau of Plant Industry during 7 years, on the methods of packing and storing Californian grapes with a view to extending the area of distribution and reaching new markets. Various grades of granulated cork and sawdust were tested with several varieties of grapes.

It was found that coarse, kilndried redwood sawdust gave as good results as the granulated cork used by Spanish packers. The redwood should be absolutely pure as the slightest admixture of pine, cedar or spruce is liable to taint the flavour of the grapes. It should be carefully dried either in kilns or in the sun and fanned to remove the finer particles which are troublesome when the fruit is unpacked. Only varieties with open bunches should be packed in this material so as to facilitate the removal of the sawdust on unpacking.

A drum barrel made of thin veneered cotton-wood, lined with heavy strawboard with a net capacity of 27 lbs has been found a most suitable container. The fruit should be cooled overnight before packing as the drums cool very slowly during refrigeration. On reaching their destination the drums should be placed in cold storage at a temperature of 32° F.

Since this system of handling grapes is an expensive one it will only prove profitable for the best grades of fruit which can be marketed at comparatively high prices, and which are unadapted to shipment in crates without a filler.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

479 - **Legislative Measures Concerning Plant Diseases, in Egypt.** — *The Agricultural Journal of Egypt*, Vol. III, Part. I, pp. 42-46. Cairo, 1913.

The principal legislative measures dealing with agriculture in Egypt are summarised and translated into French in the above article. Those relating to plant diseases are as follows:

A. Two Khedival decrees relating to the destruction of locusts, dated June 16, 1891, and April 26, 1904 respectively.

B. 1) The law No. 13, of April 17, 1905 indicating destructive measures to be taken against *Prodenia litura* (cotton worm).

2) The law No. 9, of April 17, 1910 modifying the preceding by granting compensation for additional labour in the collection and destruction of cotton leaves containing the eggs of the insect.

3) The law No. 3, of April 7, 1910 compelling notification of the appearance of *Prodenia*.

4) The law No. 14, of August 30, 1906 extending the measures of the preceding law to all insects and pests which attack the cotton and reduce the yield.

5) Law No. 13, of June 8, 1912 modifying art. 3. of law No. 13, 1905 and charging the owners of land infected by *Prodenia* with the travelling expenses of labourers sent by the administrative authority; also modifying the penalties inflicted on contraveners by art. 6 of the same law (No. 13, 1905), and by art. 1 of the law No. 3, 1906.

6) The law No. 6, of April 9, 1913, containing the measures for the prevention of the propagation of *Prodenia* by means of the cultivation of « bersim » or Alexandrian clover.

C. The law No. 19, of June 30, 1912 determining the measures for the destruction of *Earias insulana* (« cotton pod worm »).

D. The law No. 5 of 11 March 1913 for the protection of plants against the diseases of other countries (1).

E. 1) The law No. 9 of May 15, 1912 for the protection of birds useful to agriculture, appended to which is a list of birds.

2) The ministerial decree No. 46, S. A. of December 3, 1912 including in the above law (No. 9, 1912) the golden oriole (*Oriolus oriolus*).

(1) See also No. 751, B. June 1913.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

- 480 - On the Pathological Significance of Endocellular Threads in the Tissues of the Vine (1). — PETRI L. in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali, Series V*, Vol. XXIII, 1st Series, Part 3, pp. 154-161, + 1 Fig. Rome, 1914.

The writer confirms his theory that the presence of particular endocellular threads in the tissues of the vine indicates a pathological condition connected with the effects of low temperatures on the plant.

BACTERIAL AND FUNGOID DISEASES.

- 481 - Some Japanese Fungi. — ITO SEIYA in *The Botanical Magazine*, Vol. XXVII, No. 323, pp. 217-223. Tokyo, 1913.

FUNGI.

In 1910, T. MIYAKE recorded a serious fungus disease on the leaves of sugar cane, which has since been found in almost all districts. It has been attributed to a new species of *Sclerospora*, *Scl. Sacchari* T. Miyake (1911). The conidia germinate directly like those of *Peronospora*, producing a hyphal tube. Considering the differences in the process of germination, the writer proposes to divide the genus *Sclerospora* into two sub-groups: *Eusclerospora* (with conidia germinating by zoospores) and *Peronosclerospora* (conidia producing hyphae directly). Recently (1913) G. S. KULKARNI has found a new variety of *Sch. graminicola* on the leaves of *Andropogon Sorghum* in India. In this case also the conidia produce hyphae, so that *Scl. graminicola* var. *Andropogonis-Sorghi* constitutes a second member of the sub-genus *Peronosclerospora*. Comparative researches and cultivation experiments are necessary to determine if this fungus is identical with *Scl. Sacchari*.

In 1907, H. and P. SYDOW and E. J. BUTLER described under the name of *Ustilago Rottboelliae* Syd. and Butl., a smut disease found by Butler on *Rottboellia compressa* L. at Pusa. In 1913 I. MIYAKE described a fungus *U. Rottboellia* n. sp. collected by him in China (Tichang, Hupei) in September 1908. No *Ustilago* has yet been recorded on *Rottboellia* in Japan. The writer found the fungus in the province of Echigo in the summer of 1910 and has also examined a specimen collected in the same province by K. YOSHINO in August 1900.

From the descriptions of SYDOW, BUTLER and MIYAKE, the fungi found in India, China and Japan appear to belong to the same species.

(1) See No. 289, B. March, 1914.

(Ed.).

The writer's observations agree in the principle points with those of the preceding observers and the species should be named *U. Rottboelliae* Syd. and Butl.

In 1901 P. HENNINGS described a new species, *Aecidium Epimедii* Henn. and Shir. collected by M. SHIRAI as a parasite on the leaves of *Epimedium macranthum* Morr. and Decne., in the province of Izu. The teleutospore form has not yet been recorded, but in July 1905 the writer observed them for the first time, occurring in a leaf spot resembling the aecidial stage. Later he found them in various parts of the province and has observed the two forms, teleutospore and aecidium, on the same leaf. The writer, therefore, provisionally describes these forms as *Puccinia Epimедii* (Henn. and Shir). Miyake and Ito and consider them as forming a new species.

Under the name of *Gymnosporangium japonicum*, P. SYDOW described, in 1899, a fungus found by M. SHIRAI at Tokio (Komaba) on the stems of *Juniperus chinensis* L. In 1900, SHIRAI observed as a result of cultural experiments, a similarity between *Roestelia koreaensis* P. Henn (= *Tremella koreaensis* Arth.) on the leaves of *Pyrus sinensis* Lindl. and *Gymnosporangium japonicum*, in that the spores of *Gymnosporangium* not only appeared on the trunk and branches of *J. chinensis* (as in the original diagnosis of SYDOW) but also on the leaves. K. MIYABE and G. YAMADA also hold the view that the forms of *Gymnosporangium* on the bark and leaves of *J. chinensis* cannot be considered as belonging to the same species.

In order to decide this question the writer repeated infection experiments in May 1913 with spores from diseased stems of *Juniperus* (bark type of *Gymnosporangium*) and from the leaves of *Pyrus sinensis*, *P. malus* L., *Amelanchier asiatica* C. Koch and *Pourthiaea villosa* Decne. (= *Photinia villosa* D. C.). From these experiments it was concluded that the *Gymnosporangium* living on the stems of *J. chinensis* has no genetic relationship with *Roestelia koreaensis*, but with *R. Photiniae* P. Henn (= *Gymnosp. Photiniae* [P. Henn] Kern), whilst the *Gymnosporangium* on the leaves of juniper judging from its morphological characters appears to be identical with *Gymnosp. Haraeanum* Syd. Recently (1913) K. KARA has been able to establish by infection experiments, some resemblance between this *Gymnosporangium* and *Roestelia koreaensis*. K. MIYABE and G. YAMADA have observed that the germinative hyphae of the teleutospores of *Gymnosp. asiaticum* from the leaves of *J. chinensis* may penetrate the leaves of *Pyrus sinensis*, *Cydonia vulgaris* Pers. and produce the roestelia stage. There is nothing to dispute the identity, both morphological and biological, of *Gymnosp. Haraeanum* and *Gymnosp. asiaticum*. According to KERN's theory that each *Roestelia* belongs to a species of *Gymnosporangium* and that every specific name should be determined according to priority, then *Gymnosporangium japonicum* ought to be written as *Gymnosp. Photiniae* and *Gymnosp. Haraeanum* (= *Gymnosp. asiaticum*) as *Gymnosp. koreaensis*.

In damp places in Hokkaido there appears each year on the almost dead leaves of *Phragmites communis* Trin. the fungus *Napiculadium arundinacearum* (Cda) Sacc. This fungus was first recorded in Japan in 1909 by H. and P. SYDOW who had studied the material collected by I. MIYAKE in

the province of Izu. In 1910 MIYAKE described a new fungus *Brachysporium Phragmitis* found on the leaves of *Phragmites communis* at Pekin. Judging from the description and the figures, the writer considers this fungus to be *Napiculadium arundinacearum*.

482 - *Plenodomus destruens*, "Foot Rot" of Sweet Potatoes. — HARTER L. L. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 251-275, 1 Fig. + Pl. XXIII-XXVIII. Washington, D. C. 1913.

BACTER
AND FUN
DISEASES
VARIOUS

In August 1912 the writer received some diseases specimens of *Ipomoea Batatas* for examination from the neighbourhood of Dismal Swamp, Virginia. The base of the stems was covered with a fructification which appeared on superficial examination to resemble the pycnidia of *Diaporthe Batatatis*, the cause of "dry rot" of sweet potatoes (1). A careful examination of the material showed that the fructifications differed somewhat in structure from those of "dry rot" though the two forms evidently belong to the same group. At the end of the month the disease was found in all the sweet potato fields near Dismal Swamp where it caused a loss in the harvest of from 10 to 50 per cent. or even more.

In August 1913 the disease was recorded for the first time in several fields near Cape Charles and Keller. It is not known if this is its first appearance in this part of Virginia. The writer had inspected several fields in this zone during previous summers without observing the disease. It appears therefore that this disease is either new to the locality or has only previously existed in a very restricted area. The writer identifies the disease as *Plenodomus destruens*, which destroys the soft bark at the base of the stems thus causing the death of the plants. Pycnidia are formed in the diseased portions of the stem soon after the death of the plant.

The disease first appears on the stem and spreads to the tubers and branches. Artificial cultures may be grown on most media but the best development occurs on a maize or rice flour medium and on the stems of the plant. Numerous inoculation experiments have been made at Potomac Flats, near Washington, D. C., and also under glass with successful results, and the fungus has been isolated again from inoculated plants. It also attacks *Ipomoea coccinea*, but *I. purpurea* Roth. and *I. hederacea* Jacq. appear to be immune. Sweet potatoes in store are destroyed by the disease, if inoculated and exposed to the light in a damp atmosphere. These conditions have no effect on the development of fructifications in rice cultures. Its maximum development in pure culture is obtained in rice media at a mean temperature of 21.9 C. The disease survives the winter on the dead branches of the sweet potato and probably spreads by means of the seed tubers and the young shoots. For controlling the disease the writer recommends the sterilisation of the seed beds and a careful selection of the seed tubers.

(1) See No 1104, B. Sep. 1913.

- 483 - (*Bacterium aptatum*) n. sp. Injurious to the Leaves of Sugar Beets and Nasturtium (*Tropaeolum*) in the United States. — BROWN, NELLIE A. and JAMIESON, CLARA O. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 189-210, fig. 1-5, Plates XVIII-XIX. Washington, D. C. 1913.

This bacterial disease was observed for the first time in Autumn 1908 on the leaves of *Tropaeolum* (nasturtium) near Richmond, Virginia and on the leaves of sugar beets at Garland, Utah. The disease appears as leaf spots, and investigations during four years have shown that the organisms causing the disease are the same on both host plants.

The diseased nasturtium leaves gathered in the open appeared withered and discoloured and showed brown watery spots from 2 to 5 mm. in diameter. The leaves of sugar beet were received from Utah, California and also from Oregon in 1909 but at present the disease has not yet been recorded from other States producing sugar beets. The first leaves received from Utah showed spots and dark brown blotches, sometimes black, irregular in shape and from 3 mm. to 15 mm. in diameter on the petiole, the upper side and the mid rib. Occasionally the discolouration extended a short distance along the veins and the leaf tissue appeared brown and dry on both sides. Sometimes corky outgrowths appeared in the centre of the leaves. In badly diseased petioles the tissue was soft as though attacked by a "soft rot". The symptoms differ from those produced by *Cercospora* and *Phyllosticta* which are limited to small areas.

Pure cultures of the organism are capable of producing the disease in either host (sugar beets or nasturtium) and also in the pods of haricot beans, lettuce, pepper and the egg plant. The parasite probably enters the tissues of the plant through wounds or as a result of insect attacks and is probably spread by means of insects. It differs from *Bacterium xanthochlorum*, parasitic on potatoes, and from *Pseudomonas tenuis*. It differs also from *Bact. Phaseoli* though both cause spots on the leaves and pods of beans. The writers describe this new organism as *Bact. aptatum* n. sp.

- 484 - A New Chestnut Disease. — CAVARA F. in *Rivista di Patologia vegetale*, Year VII, No. 1, pp. 1-5, 2 Fig. Pavia 1914.

In this preliminary note, the writer reports that he received, in the latter part of August 1913, a score of seedling chestnuts from the forest nursery at Sienna (Italy) in an advanced state of disease. The leaves were dried up, but not attacked by parasites and the buds fell off at the slightest touch. The young stems, measuring from 15 to 20 cm. were damaged near the tip and showed a shrinkage of the cortical tissues, whilst, near the base, in the region of the second internode, they were thickened and swollen. At the first node above the cotyledons there were excrescences or nodules accompanied by rupture of the periderm, and the remainder of the stem to the hypocotyl was one mass of disease. The periderm and cortex were destroyed, thus exposing the woody tissue of the stem as in the case of a vigne stem disease ("broussins"). The root system, however, shows no exterior changes or traces of disease. From a general examination of the material, the writer concluded that the disease was localised at the swollen portion of the stem and that it was due to a bacterium.

With the object of studying and identifying the disease, fresh material was obtained in good condition at the beginning of September from nurseries at Campino near Sienna, where the disease, though not so intense as in 1913, had attacked the seedlings of the preceding year. Owing to the frequent rains in June and July and to the heavy nature of the land, the disease accounted for the death of 16 000 plants in a short time.

From the excrescences of these plants the writer has isolated an organism which differs from the well known *Bacterium tumefaciens* of E. F. SMITH (1). The parasitic nature of this organism still requires confirmation by inoculation experiments which will be carried out in the spring; meanwhile the writer describes the organism as *Bact. costanicolum* n. sp.

485 - *Polyporus dryadeus*, Root Parasite of the Oak in the United States. —

LONG W. H. in *Journal of Agricultural Research*, Vol. I, No. 3, pp. 239-250, Pl. XXI. XXII. Washington, D. C. 1913.

Polyporus dryadeus Fries has been found on oaks in the forests of Arkansas (*Quercus alba* L., *Q. velutina* Lam.) Eastern Texas (*Q. texana* Buckl., *Q. nigra* L.), Oklahoma (*Q. minor* [Marsh] Sarg.) Maryland (*Q. alba* L.) and Virginia (*Q. alba* L., *Q. rubra* L. and *Q. Prinus* L.). The disease is parasitic on the roots causing a rotting of the sap-wood and heart-wood. In all the cases examined by the writer these forms of rot do not extend higher up the tree than true rot of the trunk, but continue into the underground portions. The white rot of the heartwood of the oak and the fructification of the fungus described and figured by ROBERT HARTIG (*Die Zersetzungsercheinungen des Holzes der Nadelholzbäume und der Eiche*, pp. 124-128, Tab. 17. Berlin 1878) are connected with the fungus known in America as *P. dryophilus*.

The disease occurs chiefly on old trees, trees excessively pruned or growing under unfavourable conditions. It does not spread rapidly to adjacent trees, but is widely distributed in America and Europe and probably exists in every country where the oak grows.

INSECT PESTS.

486 - The Distribution of Gall Insects in the Flora of Milan. — Cozzi, C. in *Atti della Società italiana di Scienze naturali*, Vol. LII, pp. 514-536. Pavia, 1914.

GENERALI

The writer gives a list of 97 galls collected during 1911-13 in the plain of Milan (Italy) between Tessin and Olona and chiefly in the neighbourhood of Gallarate, the gall insects of which have not yet been investigated. The list includes 26 Diptera, 26 Hemisphera, 19 Acarinae, 18 Hymenoptera, 3 Coleoptera, 2 Lepidoptera and 4 gall insects probably new to science. The 65 host plants studied by the writer are distributed amongst 28 families and were represented largely by cultivated plants or by others useful to man.

(1) See No. 185, B. Feb. 1913.

(Ed.)

- 487 - On the Occurrence of *Aphis maidis* in West Africa (1). — VAILLET A., in *Bulletin de la Société entomologique de France*, N. 3, pp. 116-117. Paris, 1914.

This insect which is well known as a parasite on maize in the United States, on sorghum (*Sorghum vulgare* Pers.) in Australia and also in Japan, has not been previously recorded in Africa. The writer has observed it during recent years at Koulikoro (Upper Senegal-Niger). In the French Soudan, *Aphis maidis* shows a marked preference for sorghum, but it causes less damage than *A. sorghi* Theobald, which sometimes prevents the cultivation of sorghum. It seems very probable that the insect occurs also in the Egyptian Soudan.

MEANS OF
PREVENTION
AND CONTROL.

- 488 - The Destruction of Insects Injurious to Fruit Trees and Vines by Means of "Carragaheen" or "Pearl Moss" Jelly (*Chondrus crispus*). — JSSLEIB in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 2, pp. 78-79. Stuttgart, 1914.

For the destruction of injurious insects, especially *Tortry* on vines and fruits, tree the writer recommends the use of "carragaheen" or "pearl moss" jelly (*Chondrus crispus*). About 2 lbs of the jelly are boiled with 10 gallons of water for about 1 hour, water being added to make up the loss due to evaporation. The gelatinous solution is filtered and sprayed on the plants or objects containing the eggs of the parasite. On drying, a thin film remains, which becomes detached as scales containing the eggs and larvae. Dry weather is essential for this method, otherwise the gelatinous liquid is washed away.

Various insecticides may be added to the solution such as 1 lb of mustard oil dissolved in 5 pints of alcohol to 100 gallons of the solution. The cost of this latter mixture would be about £1 per 100 gallons.

(1) See also No. 79, *B.* Jan. 1913.

(Ed.).

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FIRST PART.
ORIGINAL ARTICLES

Protective Inoculations against Swine Fever in Hungary

by

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Since the year 1896 when swine plague made its first appearance in Hungary, it has caused enormous losses every year amongst the herds of swine. During the first year it spread rapidly over almost the whole country and in the following year 639 765 deaths were officially reported. After that the losses decreased, but only because the stock of pigs had considerably diminished. The usual veterinary police measures proved quite ineffectual in checking the progress of the disease and many large estates were constrained either to reduce their herds or to suppress them altogether. This very unsatisfactory state of affairs began to improve when protective inoculations were recognized as a suitable remedial measure.

Following on the results of DORSET, Mc BRYDE and NILES, which showed that the American *Hog Cholera* was caused by a virus, similar experiments were carried out in Hungary and proved entirely confirmatory, as were those of workers in other countries, proving that the European swine fever is caused by the same virus and is identical with American hog cholera.

This led to inoculation experiments being undertaken, on the same plan as those of the American investigators, by the writer and Dr. J. KÖVES; these likewise showed that pigs which have survived an artificial or natural infection can acquire a high degree of immunity and that their serum then has the property of protecting other pigs against artificial or natural infection. The experiments were repeated on a large scale in 1908; as they yielded satisfactory results, the necessary arrangements were made for producing large quantities of the protective serum. A somewhat primitive State laboratory was equipped at the stock farm at Kőbánya and was ready to distribute the serum in the spring of 1909.

The very first inoculations were successful and consequently the demand for the serum increased to such a degree, that the laboratory was scarcely able to meet it and it was found advisable to hand over the production of serum to a private company formed for the purpose, reserving the actual technical work concerned in the preparation to State officials, and submitting the company to State supervision. The laboratory was not moved, but considerably enlarged by new buildings and enclosures, the stock of pigs kept ranging between two and three thousand.

Hyperimmunisation is carried out as follows : pigs weighing about 220 lbs. and having already recovered from a slight infection, are subjected three or four times at intervals of about two weeks to subcutaneous injections on the belly. The infection consists of 300 to 400 cc. of virulent blood taken from pigs suffering from acute infection. About ten days after the last injection, blood is first drawn from their tails and finally they are bled to death by a wound in the heart. The blood obtained is immediately centrifuged and 0.5 per cent. of carbolic glycerin is added to the separated serum.

The following quantities of serum have been prepared since the foundation of the laboratory :

1909	622 839 cc.	} used entirely in Hungary.
1910	1 947 095 »	
1911	3 736 710 »	} the greater proportion used in Hungary.
1912	7 454 150 »	

Only serum that has been tested on animals and found effective is sent out. Table I shows the results of these tests on 104 six-months-old Mangalica pigs averaging 64 lbs. in weight.

TABLE I. — *Tests of swine fever serum.*

Quantity of virus — cc.	Immunising serum			Number of animals	Deaths from swine fever	
	Quantity injected — cc.	Exp. Number (?)	Date when prepared		Absolute number	Per cent
<i>Control animals</i>						
—	—	—	—	8	8	100.0
2.0	—	—	—	8	8	100.0
Total . . .				16	16	100.0
<i>Immunised animals</i>						
2.0	12.0	3/913	21. I. — 27. II. 1913	8	1	12.5
2.0	12.0	11/913	10. VI. — 21. VII. 1913	8	—	—
2.0	12.0	12/913	18. VI. — 16. VII. 1913	8	—	—
2.0	12.0	13/913	20. VI. — 31. VII. 1913	8	1	12.5
2.0	12.0	14/913	30. VI. — 9. VIII. 1913	8	—	—
2.0	12.0	15/913	10. VII. — 18. VIII. 1913	8	—	—
2.0	12.0	16/913	15. VII. — 1. IX. 1913	8	—	—
2.0	12.0	17/913	2. VIII. — 11. IX. 1913	8	—	—
2.0	12.0	18/913	22. VIII. — 13. X. 1913	8	—	—
2.0	12.0	19/913	12. IX. — 8. X. 1913	8	—	—
2.0	12.0	20/913	19. IX. — 14. X. 1913	8	1	12.5
Total . . .				88	3	3.4

(1) Every Exp. Number refers to 44-88 gallons of mixed serum. The animals were kept in infected sties throughout the experiment.

Inoculation with serum produces only a temporary or *passive* immunity, but it has been found both in Hungarian and other experiments, that if the pigs which have been treated with the serum are exposed at the same time or shortly after to natural infection, they contract the disease in a mild form and acquire a permanent or *active* immunity. Consequently serum inoculation is only advisable in the case of already infected herds of swine, and should be practised as early as possible after the outbreak of the disease on all healthy pigs and on those that are not yet severely affected, after which the herd may be left till the total disappearance of the disease in the locality. An early diagnosis of the first cases and timely inoculation are essential in order to obtain favourable results from the serum. Unfortunately in practice, errors in diagnosis are not rare and inoculation is often delayed until the plague has already caused heavy losses and the herds are already badly infected, in which case secondary bacterial infections often set in against which the serum is powerless.

In the course of five years upwards of a million pigs have been inoculated with the serum in Hungary. Accurate reports from veterinary surgeons as to the results obtained from the inoculations practised on 110 198 pigs in 836 herds up to March 1, 1914, have been received, and are summarized in Table II.

TABLE II. — *Results of serum inoculations in Hungary from April 1909 to March 1914.*

Inoculated herds		Inoculated animals		Limits of losses in inoculated herds	Total loss	
Number	Per cent	Number	Per cent		Number	per cent
408	48.8	35 738	32.4	0	—	—
156	18.7	32 734	29.7	0.1 — 5.0	667	2.0
75	9.0	12 176	11.1	5.1 — 10.0	886	7.3
81	9.7	14 096	12.8	10.1 — 20.0	2 236	15.8
720	86.2	94 744	86.0		3 789	4.0
37	4.4	5 410	4.9	20.1 — 30.0	1 270	23.4
46	5.5	5 699	5.2	30.1 — 40.0	2 140	37.5
33	3.9	4 345	3.9	40.1 and above	2 905	66.4
836		110 198			10 104	9.4

A reappearance of swine fever in herds that had been freed from it by inoculation was only rarely reported, and in these cases it is suspected that some other disease, such as swine erysipelas, was present. The permanent immunity of the animals treated with serum was also proved by thousands

of observations made on pigs, which, when hyperimmunised, were found to resist large quantities of virulent blood without any ill effect upon their health.

The experience gained in large fattening establishments is also instructive. In these cases the herds were inoculated immediately after the first appearance of the disease and suffered no appreciable loss, while formerly the havoc was almost always considerable. According to a report by CSÁKI, in one fattening establishment at Kőbánya, 19 herds with 2478 pigs were inoculated in the course of two years, after which 185 head, or 7.5 per cent., had to be killed owing to severe illness. In the second year the losses diminished considerably and in three herds none were reported. On the other hand out of 150 pigs which were left as controls and not inoculated, 62, that is 41.3 per cent., fell victims to the disease. In 5 herds which were inoculated after some delay the losses ranged between 20 and 35 per cent. (altogether 144 head, or 27.5 per cent.). In eight other herds in the same locality, whose owners would not allow their animals to be inoculated, 804 pigs out of 1404, that is 53.8 per cent., had to be killed, the losses in the various herds ranging from 29 to 86 per cent.

As a result of this experience pigs, intended for fattening are generally treated with the serum shortly after being put into the fattening sties, and losses are thus avoided. Such is the confidence in the protective action of the serum that store pigs are now bought with impunity from ordinary herds, while formerly only such pigs were admitted to the fattening pens as came from herds having recovered from a slight attack of swine fever and which on that account could be considered as immune. Differences in the value and market price of the pigs according to their degree of natural immunity have consequently disappeared.

The permanence of the results of inoculation helped to spread the practice throughout the whole country, with the result that the swine industry has successfully recovered from a period of great depression and the number of pigs in the country has considerably increased.

The practical difficulty of obtaining an early diagnosis of swine fever followed by immediate serum inoculation of the herd, led to experiments being made several years ago on the so-called *immediate active immunisation* of healthy herds, a method which is preferred to serum inoculation in North America. It consists in the simultaneous subcutaneous injection of serum and virulent blood and it also presents some drawbacks, namely: 1) that the proportion of virus to serum to be used cannot be determined previously with exactitude, and consequently one can never be perfectly sure that the inoculation will not cause serious losses, and 2) that in this way previously healthy herds get the plague and may prove new centres of infection. On the other hand the simultaneous injections have the great advantage that they can be employed at any time and that only healthy herds are submitted to them, so that errors of diagnosis are out of the question.

A large number of practical experiments were undertaken in order to judge of the value of this method in Hungary. Herds of Mangalica store pigs bought in different localities were placed on two large farms

and kept for several months in the open but separate from one another. The inoculations, which were always made by veterinary surgeons belonging to the laboratory, consisted in the subcutaneous injection of 1 to 2 cc. of virulent blood and 10 to 20 cc. of the serum. In almost all cases, after about a week well-marked reactions were observed: a certain number of the inoculated animals appeared less lively and ate their rations more slowly or not at all. These symptoms, however, usually only lasted a day, after which the animals got well again, with the exception of a few which grew worse and eventually died.

On one of the estates, between September 1910 and May 1911 ten herds comprising 3163 pigs between the ages of 8 and 14 months and weighing 50 to 120 lbs. per head were inoculated. After an incubation period of 6 to 9 days, 467 head, or 14.7 per cent., fell ill and 73 head, or 2.3 per cent., died. With the exception of one herd, in which 6.2 per cent. of the inoculated animals died on account of a simultaneous outbreak of foot-and-mouth disease, the losses in the remaining herds kept below 3 per cent. After several months the pigs were fattened, and then in three herds 4.3, 2.0 and 11.6 per cent. of the pigs respectively contracted swine fever and had to be killed; the remaining herds suffered no loss.

On the second estate, at different seasons between July 1910 and February 1914, 45 herds with a total of 15394 pigs aged from 2 to 24 months were inoculated simultaneously with virulent blood and serum. Here also more or less violent reactions were obtained after about a week, but in the great majority of cases these caused only insignificant losses, as may be seen from the following table (Table III).

TABLE III.

Number of		Deaths	
Herds	Pigs	Head	Per cent
13	3 344	0	0
27	9 894	176	1.7
1	350	25	7.1
1	290	21	7.2
1	539	44	8.1
1	351	52	14.8
1	420	90	21.4

In the first year of this experiment new cases of disease and death appeared in 8 herds several months after the inoculation reaction (altogether 72 pigs out of 2802 animals, or 2.5 per cent.). As these cases were reported as swine fever it seemed as if they were the result of a retarded reaction, but further investigations proved them to be cases of swine erysipelas, where-

upon all such cases of subsequent disease were immediately treated with erysipelas serum; the result was that only 4 animals died in one herd of 476 pigs and none at all in the other 44 herds. Out of the 45 herds that were inoculated, 37 were put up to fatten partly in the same locality and partly at Kőbánya and in no case were there any losses from swine fever. The permanence of immunity was also tested by the fact that in 7 herds, several weeks or months after the reaction, 245 pigs were infected artificially by subcutaneous injections of from 3 to 5 cc. of virulent blood, with the result that only one pig died and the others showed no signs of a reaction. Besides this, several herds were used later for the production of serum and with this object were treated with large quantities of virulent blood without suffering any loss.

The results obtained in Hungary during the last five years are in perfect accord with those obtained in North America, and show that swine plague can be successfully checked both by pure serum inoculations and by simultaneous injections. Serum inoculation is advisable for the treatment of recently infected herds and results in a rapid disappearance of the plague, provided the first cases are diagnosed soon after the outbreak and that the rest of the herd be inoculated immediately: in this case, owing to the simultaneous natural infection, they acquire a permanent active immunity. By the simultaneous inoculation with virulent blood and immunising serum the pigs get a direct active immunity. In quite healthy herds the simultaneous inoculations usually causes no losses at all or only quite insignificant ones, though there is no certainty that very violent reactions may not occur. Considering that animals thus inoculated secrete infectious virus during the period of reaction, precautions must be taken to prevent the possible spread of the disease to other herds.

The Cattle Industry in Italy at the Present Day

(Continued from p. 606).

by

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F. *Tuscany*.—The cattle in this region vary very much with the locality, but the most noteworthy breeds are the *Maremma*, the so-called *Mucca Pisana*, and especially the *Valdichiana*.

a) The *Maremma* is represented by the cattle found in the province of Grosseto and in a small part of the Pisa province; they are kept entirely or almost entirely on the pastures and present the characters of the *Podolian* type. They stand high with fore-quarters more developed than hind ones, their dewlap is abundant, their horns are thick and long, their coat is light or dark gray, darker on the fore than on the hind quarters and with black points. The cattle are semi-wild, hardy and

resistant; they are consequently especially suitable as draught animals, but of little or no value as producers of milk and meat.

b) The *Mucca Pisana* is met with here and there in Tuscany, but is especially frequent in the provinces of Pisa and Florence. Its coat is black or nearly so, and it is believed to be of Swiss origin. Some authorities are of opinion that other foreign breeds have also contributed to its formation. It is a fairly good milker and is also suitable for the production of meat and for draught purposes.

c) But among the Tuscan breeds the most prevalent and most important is the *Chianina* or *Valdichiana* breed, with its breeding centre in the Valley of the Chiana. Without entering into the question of its remote origin, which has been much discussed and is not yet settled, there is no doubt that this breed manifests some morphological characters belonging to the *Podolian* type. The animals stand high and have been called by LEYDER the giants of the species, the oxen measuring up to 6 ft. 4 in. Normal adult males in store condition weigh 1760 to 1980 lbs., cows 1320 to 1540 lbs.; at the Florence show of 1905 one fat ox weighed 2935 lbs., while cows can weigh up to 2200 lbs. These animals are unusually long-limbed; the coat is generally silvery white, with a tendency to gray about the neck and shoulders in all but the finest specimens, especially in bulls, and black points. The horns are rather short. The calves are born with a yellowish red coat which gradually turns white at between three and five months. Animals having pink spots on their tongues, muzzles, etc., or white hairs in the brush of their tails, are commonly called *mucchi* and discarded, such variations generally being hereditary and showing a tendency to albinism which is considered a sign of degeneration; *mucchi* are nevertheless markedly suitable for fattening. *Valdichiana* cattle are remarkable for their early maturity and fineness. They are both good draught animals and good meat producers, in fact with regard to this latter quality they can compete with breeds bred specially for the purpose. They fatten rapidly and kill well, yielding as much as 70.9 per cent. in carcase tests and never less than 60 per cent. Their strength as draught animals has been slightly reduced through the excessive refinement of the breed, so that they are now only used for haulage and agricultural work on the plains and on rather loose soils. As for milk, the cows barely produce enough to rear their own calves. The breed has been famous for a considerable time and has been studied and illustrated more than any other Italian breed. Of late years it has been the object of special attention on the part of distinguished scientists and enthusiastic breeders, amongst which Prof. EZIO MARCHI, Count PASSERINI of Bettolle (Arezzo) and the Counts of FRASSINETO (Arezzo) deserve to be mentioned. It has spread beyond the limits of its own district, not only in Tuscany itself but also in the Upper Tiber Valley, in Umbria and elsewhere.

G. *Marches and Umbria*.—These two regions being situated between Tuscany and Romagna on one side, and the Abruzzi and the Roman Campagna on the other, their cattle represent as it were an intermediate

stage between improved conditions of animal husbandry and its initial phases. Nevertheless, even here, marked progress may be recorded during the last few years. The inhabitants of the Marches classify their cattle into three groups which they consider as three distinct breeds.

a) The *mountain* breed, small and hardy animals, poor producers of milk and of meat, belonging to the *Podolian* type. On the high mountains pure *Maremma* cattle are frequently imported.

b) The so-called *plain* or *improved* cattle of the Marches, which is also called the *Perugia* breed, and which is the most important. It is the result of crossing the *Valdichiana* with the native cattle of the *Podolian* type, which was carried on during the second half of the last century. The *Valdichiana* characteristics which now predominate in this breed are somewhat too exacting for local agricultural conditions; but the latter are gradually being improved and the infusion of some *Romagna* blood is also tending to adapt the cattle to their surroundings.

c) An intermediate breed is found on the hills, especially in the provinces of Ancona and Ascoli Piceno. It is the so-called *brina* or *marina* breed, and is the result of crossing the mountain and plain cattle. Gray in colour, but lighter than the mountain breed, it is smaller and more compact than the improved breed, being also coarser, harder and very suitable for draught purposes.

In the country about Fermo and Pesaro a good many pure *Romagna* are bred and are daily becoming more popular in the Marches.

Umbria appears to have no distinct indigenous breed. The mountains are mostly stocked with *Maremma* cattle, and the plains and the valleys with *Valdichiana* or *Perugia* cattle.

H. *Latium, and the Southern Adriatic and Mediterranean regions.* — To the south of the Marches and Umbria the prevailing cattle all belong to the *Podolian* type, which undergoes various local modifications. Occasional imports of improved Italian or foreign breeds are met with, especially amongst dairy cattle near large towns, in which case the *Schweytz* are the most popular, though other breeds are also represented. The first imports of foreign cattle date back to early times. The Bourbons imported animals from Switzerland and from England, and traces of these are visible in the cattle of the neighbourhood of Naples and of the whole Sorrento peninsula. Of late years the imports have increased, not only to supply the city dairies with milk but also to improve the native cattle. The best results have usually been obtained with the *Schweytz* breed on account of its remarkable adaptability.

The native *Podolian* or *Apulian* cattle are kept out on the pastures and receive no sort of attention unless environmental conditions make it imperative or unless the animals are required for draught purposes. They are allowed to breed promiscuously, or almost so, and this accounts for the lack of differentiated breeds, the local modifications which occur being due to natural external agencies.

The cattle of *Latium*, frequently called the *Agro Romano* breed,* represent one of these modifications and are characterised by uniformity,

due to the relatively uniform conditions under which they live. They are above the average in stature, strongly built, with long thick horns and a rather dark gray coat.

The animals are very hardy, robust, almost wild and especially suitable for draught purposes.

Throughout the whole region it may be said that the cattle found on the hills are hardier, smaller, darker in colour, and produce less milk and beef than the cattle of the plains and valleys.

J. *Sicily*. — Animal husbandry occupies a very secondary position in the agricultural economy of Sicily, which is one of the poorest regions in cattle of all Italy. The number of stock, moreover, shows little sign of increasing, owing to the scarcity of keep. Cattle are kept almost entirely in the open, and only rarely housed.

Experiments have been made to introduce foreign breeds, especially in the neighbourhood of the large cities, but with indifferent success. Crosses have been attempted with *Schweytz*, *Simmental*, *Valdichiana* and even with *Dutch* and *Shorthorns*, but only the *Schweytz* have given good results.

The native or *Sicilian* cattle are usually divided into three sub-breeds:

a) The *coastal, plain*, or *Modica* breed which occupies the district of Modica and the western slopes of Etna.

b) The *Mezzalina*, or *hill* cattle, in the province of Trapani and the plain of Catania.

c) The *mountain* breed, found in the high mountains, as in the districts of Mistretta, Patti and Nicosia.

The *Modica* cattle are the most esteemed, and are most typical of the breed. They stand rather high (oxen up to 5 ft. 8 in.) and three-year-old bulls weigh from 1320 to 1650 lbs. The coat is light or dark red — darker on the fore quarters and on the more exposed parts of the body — with black points; the horns are rather short, especially in the males, and black tipped; the dewlap is somewhat large, especially in the males. The cows have well developed udders. They are good draught animals and milkers, but not very suitable for meat production.

The milk yield varies considerably with the individual and with the season. In a good season when there is plenty of feed on the pastures, some cows will yield as much as $3\frac{1}{2}$ to $5\frac{1}{2}$ gallons of milk daily and even more during the spring and autumn; some cows are said to have given as much as 660 gallons of milk at one lactation, but during the summer heat the secretion of milk ceases.

The *mountain* cattle are small and very hardy; their horns are very long and their coat is a much paler red; they are strong and resistant, but are not good for the production of either milk or meat.

The *Mezzalina* sub-breed occupies an intermediate position both for size and other characters.

K. *Sardinia*. — Agriculture in Sardinia is prevalently of an extensive nature, based on the production of live stock and cereals. Livestock is of the greatest importance in Sardinia. Cattle especially are the chief source

of wealth and of recent years have both increased in numbers and improved in quality.

The old Sardinian is gradually disappearing, leaving in its place the improved breed which is becoming increasingly popular on the markets of the mainland. Only in the mountains and in out of the way places are those small animals still to be seen, which formerly were characteristic of the whole of Sardinia and which stand only about 4 ft. high and weigh under 550 lbs. Their coat is reddish or yellowish, with black muzzles, brown switches to their tails and brown rings round the eyes; their horns are long and thick, and their yield of milk and meat is very poor.

The present cattle is the result of repeated crosses with imported breeds. Bulls from Sicily, Piedmont, Lombardy, Tuscany and the Marches were first imported for the purpose, but of late *Schweytz* bulls have been preferred, and every year they are now imported on a large scale. The cattle have much improved with regard to size, early maturity and milk and meat production; at the same time, they are good draught animals; their live weight ranges from 1320 to 1760 lbs. These results have been obtained in spite of the very primitive conditions under which the animals are still reared.

From the foregoing account of breeds and their distribution, it is apparent that the cattle industry in Italy has undergone considerable development in recent times, and is likely to increase in this direction with the spread of education and of the cooperative spirit. Nevertheless, much remains to be done and a higher degree of production will hardly be reached in many parts unless State aid be granted to start the process of improvement.

Recent Experience and Progress in Beekeeping in Germany.

by

F. GERSTUNG,

Editor of "Deutsche Bienenzucht in Theorie und Praxis", Oesmansledt in Thuringia.

Beekeeping in Germany had made satisfactory progress both in theory and practice, notwithstanding the unfavourable conditions of weather and of yield, which, during recent years, have diminished the returns of this industry.

The action of the State in establishing institutions for research and instruction, and the organisation of theoretical and practical courses of beekeeping, now held regularly every year in almost all the beekeepers' associations in the Empire, have largely contributed to the progress of beekeeping. Thus in Bavaria, which numbers about 50 000 beekeepers, a scientific institution for the study of bees has been founded at the University of Erlangen; here, elementary and advanced courses are held on beekeeping, bee diseases, the breeding of queens, etc., under the direction of Professor ENOCH

ZANDER. This institution is under the general supervision of the Professor of Zoology, Dr. FLEISCHMANN.

The results of the scientific work of this institution have been published in the work of Professor Zander: *Handbuch der Bienenkunde in Einzeldarstellungen* (1). The yearly reports are published in the *Landwirtschaftliches Jahrbuch für Bayern* (2).

Every year scientific and practical courses for persons from all the confederated states are held at the Royal Horticultural Institution at Dahlem, Berlin. The scientific instruction is given by Dr. KÜSTENMACHER, professor of beekeeping in the institution, and other teachers (for chemistry, botany, etc.). The practical instruction is given by the writer of this paper or by other leading men of German beekeeping. The reports upon the work of the Institute appear regularly in the *Bericht der Königl. Gärtnerlehranstalt zu Dahlem bei Berlin* (3) (Report of the Royal Horticultural Institution of Dahlem near Berlin), made by the Director, Herr Oekonomierat TH. ECHTERMAYER.

The director of the Biological Institute at Dahlem, Dr. MAASSEN, occupies himself especially with the diseases of bees. It is to a great extent due to him that the etiology of foulbrood has been satisfactorily and scientifically explained; on the basis of the results of his investigations a bill has been drawn up on foulbrood and other contagious diseases of bees, which will probably be discussed and approved by the Reichstag in the course of this year.

The Imperial Sanitary Office (*Reichsgesundheitsamt*) has published a memorandum on the honey trade, in which it warns German beekeepers of the danger that threatens them in the shape of cheap foreign and artificial honey, and communicates the measures adopted by the authorities and the decisions of the law courts for the protection of beekeepers and of the honey-consuming public. Dr. KÜSTENMACHER published in the *Deutsche Bienenzucht in Theorie und Praxis* (4) year 1910, a series of articles with the object of explaining scientifically "what is honey", upon which the Reichsgesundheitsamt published an *Entwurf zu Festsetzungen über Honig* (Draft of definitions of honey), which contains the preliminaries and bases for a law on the protection of honey demanded for many years past by German beekeepers. In consequence of the improvements in the methods of examining honey, due to the labours of Professor HAENLE of Strasburg, Dr. FIEBE of Berlin, Prof. LANGER of Graz, and others, it has become easier to distinguish with certainty between pure and mixed or adulterated honeys and to prove the kind and degree of adulteration.

As for the special questions connected with the study of bees, which during recent years have awakened most interest, we can in this short review only mention the more important.

(1) Published by Eugen Ulmer, Stuttgart.

(2) Published by Carl Gerber, Munich.

(3) Published by Paul Parey, Berlin.

(4) Published by Fritz Pfenningstorff, Berlin.

The discussion as to the notion of the bee colony still continues. The anthropomorphic theory and the so-called organic theory oppose each other. The first considers the colony as a closed family (called also a State) of several individuals united for the purpose of conservation and reproduction, and who, in consequence of their special endowment and intelligence, are capable of adapting themselves suitably to the structure of their state and of finding out and fulfilling the special function which each has to perform. The other theory, that of the so-called organic point of view, which has been introduced and defended by us, considers the colony as a whole as a living unit, which, according to its wants for the conservation of the species, develops out of itself special organs in the form of different beings which form the colony. The various functions which are indispensable for the preservation of the whole are correspondingly distributed among its members according to their age and sex. The preservation of the colony is not based on the free choice of functions by each member, which presupposes a certain intelligence in the bees, but by the difference of the physiological structure of the individual members and of the whole colony, caused by the conditions of their life, from which arise the capacity for and necessity of the various forms of activity for the conservation of the whole, to the exclusion of the free choice of functions on the part of the individual. The organic point of view has found decisive scientific support from the recognition that certain organs develop and begin to function only at certain periods, and after having fulfilled their duties disappear again. It is known that the wax glands do not develop their full functional activity until about 8 days after the emergence of the young bees and then retrograde until they cease to act; further, that the young nurse develops to its full perfection a gland which is only found at this stage, but which is necessary for the digestion of pollen, and that this gland gets atrophied as soon as the bee has passed the stage of nurse bee and has become a worker. This shows clearly that the most important functions for the preservation of the colony and of all its members are connected with the various ages and with corresponding physiological states and anatomical transformations. The organic theory recognizes logically a rigorous division of work, which represents the real basis for all the measures adopted in the practice of beekeeping. It adapts its methods as much as possible to the biological laws of the colony and endeavours to practise systematic beekeeping. The organic theory of the bee colony and its consequences for the theory and practice of beekeeping are treated *in extenso* in the book *Der Bien und seine Zucht*, 4th Edition (Berlin, Fritz Pfennigstorff).

The question of *parthenogenesis*, which has been so much debated during the last sixty years is again the subject of lively discussion. The most minute investigation into the eggs of bees has proved that the original opinion of Dr. DZIERSON is still scientifically well founded; according to his theory the male members (drones) issue from unfecundated eggs, while the female members (queens and workers) hatch out from fecundated ones. Dr. NACHTSHEIM of Munich has furnished scientific proof of this, while Prof. BRESSLAU of Strasburg has recognized and described the mechanism of fecundation.

Nevertheless, even these new discoveries fail to explain how the queen is capable of fecundating her eggs or not according to their destination.

On the *origin of the bee pup* which the young larvae get during the first four days of their development, no unanimity of opinion has been attained in spite of intense investigation. Professor ZANDER and others uphold SCHTEMMENZ' views, according to which the nutriment proceeds from the glands of the head and thorax of the young nurse-bees. Dr. KÜSTENMACHER shares LEUCKHART-SCHÖNFELD's opinion, namely that the chyle stomach produces the bee pap. The latter considers the chyle stomach as the seat of the production of propolis.

It is satisfactory to note that of late years eminent zoological scientists have turned their attention to investigations on bees, and one may hope that before long many obscure points will be cleared up.

Practical beekeeping in Germany has, during the last ten years, undergone far-reaching changes. The most striking is the change from the fixed (basket) or skep hives to the movable bar frame hive and in the latter from the system of hives having the opening behind to that with the opening above. Quite recently horizontal hives have taken the place of vertical ones, and lastly, large hives are used instead of small ones.

The completely changed conditions of the honey-bearing flowers, which have converted the districts in which formerly the honey was gathered late into early yielding districts, have led to fixed hives falling more and more into disuse and being now almost limited to the heaths. In East Prussia, where formerly only basket hives (Kanitz hive) were common, the so-called mixed system prevails, that is the Kanitz basket hive is used as brood hive and for winter quarters, while a large lift with movable bar frames is placed on it for the honey. In this way it is possible to obtain centrifugated honey without destroying the combs. Nevertheless, the new bar frame hives are continually spreading in East Prussia.

In 1880, at the meeting at Cologne, uniform dimensions for the bar frame hives, which are still frequently called Dzierzon or Berlepsch hives, were fixed upon, the so-called *German-Austrian standard* (8.79 in. wide by 7.29 in. high for half frames and 14.58 in. high for whole frames). It soon appeared that these dimensions were not favourable to the development of the colonies. The early collection of the honey demanded a numerous population already in May and June, to be able to utilize completely the season which was often very short. This was not, however, possible with the standard hive, except with much trouble and difficulty, by enlarging the brooding space and similar measures.

At the same time as the insufficiency of the standard measures was recognized, the discovery was made of the laws which govern the making of wax and of the brood cells, which was to prove of the greatest importance in the construction of hives (1). With the demand for more space for the development of the colony was added the one due to a better knowledge of

(1) See: *Grundgesetz der Brut- und Volksentwicklung des Biens*, sixth edition: Berlin, Fritz Pfennigstorff.

the nature of a colony, namely for *Space corresponding to the population*. Thus scientific dimensions were introduced into Germany during the last twenty years and they have given satisfaction throughout the country. They are the following: 15.75 by 9.84 inches or 155 square inches for the comb without the wooden frame, and nine such combs afford the colony a sufficient brooding space. These dimensions, wherever they have been applied with understanding, have given the best results, and it seems that their substitution for all the others will be only a question of time. It is hardly to be expected that these will ever be replaced by other dimensions, as with them the habitation of the colony is made according to its requirements. The colony itself ought to change before other dimensions could be considered suitable.

This systematic brood comb has been adopted in many systems of hives which formerly used the standard dimensions, as for instance the Berlepsch, the four-storied Liedloff, the Alberti, the German-American and other hives. Most modern hives are built according to these dimensions.

On the introduction of this modern system the influence of America was felt. Almost all the American forms of hives prefer the isolated position of the colonies in the open under a separate protecting roof, which naturally suggested the idea of handling the colony from above. This method at first seemed strange and unusual to German beekeepers, who mostly kept their colonies in bee houses and handled them from the back of the hive. The handling from above and the new dimensions encountered many difficulties, and had to struggle with much prejudice, but with time all hostility has been overcome. When, during the last five years, the horizontal hives became the fashion in Germany, the handling from above, which a short time previously was held to be impossible, began to be considered quite natural.

When the systematic dimensions were introduced the vertical hives were preferred, that is those with high frames. For countries without late honey these hives are even now the best form, as they oblige the colony to provide first of all the necessary store of food for the winter and to deposit it overhead, before bringing the beekeeper's share into the lifts. These hives, by their special build, prevent the pernicious practice of feeding with sugar and causing the degeneration of the bees.

Certain conditions of the honey crop (fir and heather honey, etc.) render it necessary to remove all the honey from the body box or to collect as comb-honey all that which cannot be removed by centrifugation. This is not easy with the vertical hive; consequently, by the side of the vertical hives, have been introduced the horizontal ones, in which the modern brood comb is simply laid on its side without altering its dimensions. It is advisable to build the horizontal hives with the frames at right angles to the side which bears the alighting board and entrance.

The horizontal hive induces the bees, without any effort on the part of the keeper, to deposit all the honey they collect in the lifts, whence it can be easily collected. This can cause the body box to be completely freed from

honey when the booty is not heavy and sometimes in very poor years it can even endanger the existence of the colony.

The more unfavourable the conditions of the supply of honey-bearing flowers, the greater must be the care bestowed on the bees in order to get satisfactory returns from them. We cannot enter more fully into the subject, which, besides, is treated in every modern work on beekeeping.

An unforeseen difficulty in the way of adapting beekeeping to the changed conditions in the supply of honey-bearing flowers arose by the introduction made some decades ago of foreign breeds of bees, which hybridized the native bees that were well adapted to their environment, and in most cases spoiled them. It became necessary to breed, by selection, a bee suitable to present conditions. This was no easy task, as it is not possible to select a particular male (drone) for the mating. The impulse to the scientific breeding of queens, from both the theoretical and practical points of view, came from America. VON STACHELHAUSEN worked out several sure methods and introduced them into Germany by his book: *Der Bien und seine Zucht*. The Swiss also, under the leadership of Dr. KRAMER of Zürich, have devoted much care to the breeding of queens, which at present awakens much interest in Germany and is practised with success.

The recent investigations into the laws of heredity have yielded new principles and methods in the selection of breeding stock and of breeding, so that at present methods founded on scientific bases can be employed to obtain, by means of selection, the desired qualities.

In conclusion, the following are some statistics concerning bees and honey. On December 1, 1912, the total number of beehives in the German Empire was 2 619 891, the highest on record. East Prussia, Württemberg and Baden have had the greatest increases. The importation of wax amounted to 2952 tons, worth £409 500, the exports to 1 430 tons, worth £210 500. Duty was paid in 1912 on £129 360 worth of honey.

German beekeepers attempted in 1913 to unite all their associations into one in order to defend their interests vigourously, but they have not yet succeeded in the proposed unification.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT
OF AGRI-
CULTURE IN
DIFFERENT
COUNTRIES

489 - **The Agricultural Conditions of Albania.** — SEDLMAYR, E. C. in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 31-32, pp. 279-280. Vienna, April 22, 1914.

Leaving out of consideration the mountain pastures, whose area is difficult to estimate, the area of the land available for agriculture in Albania is between 500 000 and 600 000 acres. The most extensive estates are situated in the large plains along the sea, while the best soils are in the mountain valleys of the large rivers.

The greatest landowner is the State, and the large estates of which it disposes are partly absolute State property and partly « mewkuf » and « vacuf », i. e. ecclesiastical property. The large private estates are in the hands of about five great families, each of which possesses from 100 000 to 150 000 acres of land. Medium-sized estates of about 500 to 1000 acres in extent are fairly common all over the country, while peasants' farms of about 25 acres are rare in the plains, but prevalent in the mountains.

The large estates, both State-owned and private, and many of the medium-sized estates are worked on the share system. The size of the farms (« tschiftlik ») depends upon the number of members in the farmer's family and upon the quantity of live stock he possesses. One-tenth of the grain crop (« dim ») goes to the State; of the remaining nine-tenths, one-third goes to the landowner, and the rest or six-tenths to the farmer. In southern and central Albania large tracts of country lie fallow or are merely grazed, owing to the scarcity of farmers; at present barely 20 per cent. of the whole cultivable area is being farmed.

Agriculture is still in its infancy, the only implements used for tilling the soil being a primitive wooden swing-plough and a harrow formed of a bundle of thorns. Only quite recently some of the very largest farms in the north have provided themselves with modern ploughs, hay balers

and a few other implements. Regular rotations are unknown. The most common crop is maize grown continuously, while small areas are put to wheat, rye, barley and oats. In some places tobacco, flax, hemp and cotton are to be seen, and to the south of Skumbi also rice fields. The agricultural produce is chiefly devoted to the needs of the local population, for means of transport are not only insufficient, but also unsafe.

Live stock is rather more important than the raising of crops, but is also conducted on extensive lines. Stabling is almost unknown, the animals being kept on the open pastures until they are ready for the market. The horned cattle are represented by the so-called Illyrian breed, small animals rarely attaining a height of 3ft. 6in., yellowish brown, yellow or gray brown in colour and generally uniform; the buffaloes often met with in the plains are more strongly built, larger and better developed. The native horse is small, hardy and very thrifty and is very suitable as a saddle and pack horse. Asses and mules, especially in the south, are not rare. In the mountains, sheep prevail, especially in the form of a kind of Zackel sheep which supplies the peasants with meat, wool and skins, as well as milk. Goats are kept; throughout the country, but especially in the mountains, they are a fine, well-developed breed. Very fine poultry are also found in Albania, while in many localities bees are kept, but in a most primitive fashion.

Oil and wine making are important branches of agriculture, while amongst fruits quinces and pomegranates thrive very well, besides plums, apples and pears, and in the north walnuts are abundant.

The grazing lands are extensive tracts often covered with bracken or scrub, or almost desert like with scanty herbage growing among the stones. At other times they are arable land allowed to fall back into pasture. Meadows are rare and only attain any importance in the north. Grass leys are quite unknown.

Forestry has been still more neglected than agriculture and live stock, and extensive tracts of forest have been spoilt or completely destroyed by injudicious management. It is only in out-of-the-way valleys in the high mountains that valuable forests still exist.

In conclusion, the writer points out that agriculture may flourish and develop in Albania provided that the numerous rivers of the country be utilized systematically for irrigating the extensive plains and for the production of electric power, and that the means of communication be improved, the conditions of ownership settled, and the working classes educated.

490 - **Agriculture in the Argentine Republic.** — HERMES, A., with the assistance of HOLTMEIER-SCHOMBERG, H. — *Berichte über Landwirtschaft*, published by Reichsamt des Innern, pp. VIII + 311, 48 tables and 17 maps. Berlin, 1913.

The writer discusses in the introductory chapters the geographical position, area, history, the orographic, geological and soil conditions, as well as the hydrography and climate of the Argentine Republic. He reviews also the conditions of its native population and immigrants, and of the means of communication, and then proceeds to a description of the agri-

cultural conditions of the country, from which the following data are extracted.

Agriculture in the Argentine is still very extensive in character and is especially characterized by a simple and very distinct division between the cultivation of the soil and animal husbandry. These two great divisions of agriculture exist side by side and each has its own sphere of action and its own means of accomplishing its work.

Cultivation of the soil. — The owners of the numerous large estates ("estancieros"), devote themselves almost exclusively to the raising of livestock; they cultivate the soil only temporarily and then only indirectly by means of colonists' families and only with the object of improving the food supply for the stock, *i. e.* of producing forage, especially lucerne. The still unbroken areas to be put to lucerne, or worn-out lucerne fields, are broken up by the colonists and cropped with wheat on the share system. With the last cereal crop, lucerne seed, provided by the estanciero, is sown and the colonist pulls down his primitive mud hut and moves on to another part of the estate to repeat the same process. The colonist's agreement with the landowner is usually made in one of the two forms: "a medias" and "per tanto". According to the former the owner generally takes half shares both in the outlay for certain items such as seed, reaping and threshing, and in the returns. According to the second system the "tantero" bears all the farming expenses and pays a small percentage of the gross returns to the landowner for the use of the land.

One of the chief causes of the great spread of the share system in the Argentine is the shortage of labour and its high price.

Besides this, the character of the seasons largely affects the demand for labour during the summer over the extensive agricultural tracts.

The cultivation of the soil, as has already been mentioned, is only an accessory object, and has naturally undergone later and slower development than animal husbandry, which has been the prominent feature from the beginning. Only where medium and small holdings are more prevalent, as in the old colonists' centres of the chief provinces, especially in Santa Fé, is there unmistakable evidence of mixed farming. The cultivation of cereals on a large scale by individual owners or by contractors is not very frequent.

Except during the earliest periods of development in the seventeenth and eighteenth centuries, when the Cuyo provinces of Mendoza, San Juan and San Luis provided not only Argentine and Chile but also Brazil with wheat flour, Argentine has until recently been dependent on foreign countries for her corn. It was only in the seventies of last century that the country developed from an importer of cereals into a cereal exporting country, and she has come to occupy one of the most prominent positions amongst such countries in an astonishingly short space of time.

The agricultural area of Argentine was 1 432 620 acres in 1872 and had become 50 306 693 acres in 1910; that is in barely 40 years it had increased more than thirty fold. While the area of the cultivated land in 1872 was only 0.19 per cent. of the total area of the country it attained 6.82 per

cent. in 1910, and, notwithstanding the great progress achieved, this latter figure shows the great future possibilities of agricultural development in the country. Development has been especially rapid since 1895. Between 1895 and 1909 the cultivated land increased fourfold and the development has been most rapid in the central provinces of Buenos Aires, Entre Rios, Santa Fé and Cordoba, the cultivated area of which is much greater than that of all the other provinces and territories put together.

The export of cereals is due to the unceasing spread of cultivation. At first imports rose with the rising exports and it was only in 1877 that the exports were surpassed by the imports.

Table I shows how the value of the exports of animal products were gradually exceeded by the products of the soil, till, in 1908, the latter amounted to twice as much as the former.

TABLE I. — *Value of exports of plant and animal products from Argentina for the period 1896-1910.*

Years	Plant products (1)	Animal products
	£	£
1896	8 563 085	14 003 079
1897	4 632 955	14 700 308
1898	8 475 799	17 347 820
1899	12 935 379	22 439 457
1900	15 341 406	14 145 990
1901	14 213 929	17 995 976
1902	13 534 012	20 754 090
1903	20 895 477	21 675 704
1904	29 844 630	20 917 973
1905	33 796 696	28 001 177
1906	31 299 088	24 644 730
1907	32 577 008	24 581 949
1908	47 980 018	22 854 396
1909	45 761 815	30 483 860
1910	39 046 835	31 964 539

(1) Exclusive of forest products.

Agriculture in Argentina presents a rich variety of cultivated plants, as may be seen from Table II, which shows the increased area of the various crops since the beginning of the seventies of last century, a period which may be considered as the starting point of the recent agricultural development in the country.

TABLE II. — *Increased acreage of various crops, 1872-1909.*

Crops	Cultivated area in acres.				Percentage of increase in the period 1895-1909
	1872	1888	1895	1909	
Wheat	(1) 180 627	2 015 021	5 064 951	14 422 690	+ 185
Maize.	322 304	1 980 796	3 074 491	7 425 625	+ 141
Flax	84	?	357 112	3 596 919	+ 276
Oats	—	—	?	1 414 946	+ 1 382 (2)
Barley	4 233	?	134 857	148 293	+ 10
Lucerne	261 397	963 747	1 762 112	11 630 259	+ 560
Potatoes.	5 834	?	52 100	119 882	+ 130
Pulse	9 254	?	51 401	64 248	+ 25
Wine	9 019	63 393	82 680	302 607	+ 266
Sugarcane.	6 062	52 046	151 411	174 830	+ 16
Tobacco	8 552	?	39 031	23 591	+ 65
Cotton	996	30	2 172	4 295	+ 98
Earthnuts	5 901	?	33 298	29 530	— 13
Vegetables.	—	?	58 216	93 901	+ 61
Trees in general	—	89 268	504 656	1 641 819	+ 225
Other cultivated plants	70 406	912 406	120 093	5 302 247	+ 4 315
Total cultivated area (3) . . .	1 433 252	6 076 707	12 088 582	46 395 634	+ 284

(1) This figure is too low, since the provinces of Buenos Aires, Entre Rios and Rioja, for which no statistical data could be obtained, are not included.

(2) The acreage under oats was not ascertained in 1872 nor in 1888 and 1895. The calculation of the percentage of increase is based on an estimate made in 1896, according to which the area was 95 401 acres.

(3) These figures are taken from official returns.

The class "other cultivated plants" consists almost entirely of grass leys, which in the year 1909 amounted to 5 154 008 acres. Here also the increase has been very considerable since 1895.

The great extent of the Republic, embracing various climates, is the reason for the diversity of crops cultivated. Together with the common cereal and forage crops, vines and subtropical and tropical plants grow to perfection. The rapid and extensive spread of wheat, the chief Argentine cereal, in comparison with that of subtropical and tropical plants, is due not only to favourable natural conditions, but also to the excellent position, as regards means of communication, of the principal wheat belt (Central Argentine). The same is true within certain limits of maize and lucerne. In 1909 these three plants occupied more than two-thirds of the whole cultivated area of the country.

On the other hand the chief territory in which tropical and subtropical crops, such as cotton, tobacco and coffee, are raised, namely Northern Argentine, lies at a greater distance from the European market and is far less well provided with means of communication than the coastal zone. With the present opening up of the large northern belt, however, the cultivation of tropical and subtropical crops is sure to increase rapidly, as the natural conditions are decidedly favourable.

• Sugarcane is very important in the Argentine. The economic organisation of the province of Tucuman, which is the chief centre of its cultivation, is based upon it. Jujuy and Chaco come next in order of importance, and, at a distance, Santa Fé, Corrientes, Santiago del Estero, Salta and Formosa. Vine growing is also important; whilst in 1872 the total acreage under vines was only 9016 acres, in 1888 it was 63 360 acres, in 1895, 80680, and in 1909, 302 509 acres. Between 1895 and 1909 the area under vines almost quadrupled itself. More than three-quarters of this area is situated in the provinces of Mendoza and San Juan, the former with 119 848 acres, and the latter with 119 680 acres.

Live stock in general. — Table III shows the development of live stock in the Argentine between 1888 and 1908.

TABLE III. — *Head of live stock 1888-1908.*

	Year			Percentage of increase or decrease		
	1888	1895	1908	1888-1895	1895-1908	1888-1908
Horses	4 262 917	4 445 859	7 531 376	4.29	69.40	76.67
Mules and asses.	430 940	483 369	750 125	12.17	55.19	74.07
Cattle	21 963 930	21 701 526	29 116 625	— 1.19	34.16	32.57
Sheep	66 701 097	74 379 562	67 211 754	11.51	— 9.64	0.77
Pigs	403 203	652 766	1 403 591	61.15	115.02	248.11
Goats	1 969 765	2 748 860	3 945 086	39.04	43.52	100.28

The province of Buenos Aires, by far the largest of all, possesses more than one-third of all the cattle, one-third of the horses and upwards of one-half the stock of sheep and pigs of the whole Republic. On the other hand it is the last but one of all the provinces with regard to its stock of mules and asses and the last of all for goats. As for the value of the live stock, the province of Buenos Aires owns more than half the total. It is followed by the provinces of Santa-Fé, Entre Rios, Corrientes and Cordoba. Among the territories La Pampa occupies the foremost position.

The livestock at present existing in the Argentine Republic has been greatly improved by the introduction of European blood. The number and value of animals imported for breeding purposes between the years 1880 and 1907 (1) is shown in Tables IV and V.

(1) Unfortunately no reliable official statistical data as to the imports of breeding stock before 1880 are available.

TABLE IV. — *Number of live stock imported into the Argentine Republic between 1880 and 1907.*

Exporting country	Cattle	Horses	Asses	Sheep	Pigs	Goats
England	14 477	3 102	352	65 947	1 945	—
France	583	1 580	112	1 184	3	4
Germany	153	120	—	3 327	12	—
Belgium	325	156	—	209	56	—
Holland	50	26	—	10	14	—
Spain	42	84	839	128	4	4
Italy	62	79	57	56	6	2
United States . . .	169	28	9	504	161	—
Australia	—	—	—	125	—	—
Various	10	11	—	33	5	—
	15 871	5 186	1 369	71 523	2 206	10

TABLE V. — *Value of live stock imported into the Argentine Republic between 1880 and 1907.*

	Total value £	Average value per head £ s d
Cattle	796 330	50 4 0
Horses	344 640	66 9 4
Asses	32 821	25 19 5
Sheep	715 079	10 0 0
Pigs	19 617	8 17 5

The total value of the animals imported into Argentina between 1880 and 1907 amounts to upwards of £1 900 000, the greater part of this sum going to England as the chief purveyor of the best live stock.

Horse breeding. — For centuries breeding was left almost entirely to nature without any human interference. Natural selection produced the native Criollo horse, which was extraordinarily hardy and resistant. In the second half of the nineteenth century this primitive system of horse-breeding underwent a great and unfavourable change owing to the enclosure of pastures with the formation of "bretes" or corrals, to the ruthless decimation of the herds of horses for their hides and to the slaughter of thousands of the best and heaviest horses for the numerous tallow factories. On the other hand the importation of the best European breeds, which commenced in the second half of the nineteenth century and increased rapidly, had a lasting effect and considerably modified

the Criollo horse. Vast tracts of country are now stocked no longer by pure Criollos, but by heterogeneous crossbreds, compared with which the number of pure-breds raised on the most up-to-date estancias is relatively small.

Thoroughbreds are the only type of light horse which has acquired a real importance in the Argentine Republic, owing to the passionate interest taken by the population in horse racing. No other country has invested such considerable sums in Thoroughbreds in so short a time. Amongst the other breeds of light horses introduced into the country, Hackneys undoubtedly take the lead. They are bred now with the greatest care in a number of the best estancias. From a purely zootechnical point of view their acclimatisation has been one of the most successful in the Argentine; nevertheless their popularity has never spread and their distribution today is purely localised and confined to the neighbourhood of the great metropolis, Buenos Aires. The other types of light English horses, Yorkshire and Cleveland, have not acquired any special importance in the Argentine. The Anglo-Normans, which have been imported of late years in fairly large numbers, deserve to be mentioned, as they seem to be steadily gaining favour. Other types of light horses have also been imported, such as Hunters, Morgans, Russian and American trotters, Arabs, and, among German breeds, Trakehners, Oldenburgers, Holsteiners, and East Friesians, but without great success up to the present, owing in part to the fact that the experiments are very recent.

Among heavy draught horses, Clydesdales and Shires, the former especially, have long been most popular, but of late Percherons have become serious rivals and have gained much ground in a surprisingly short time owing to their general usefulness and to the good results they have given when crossed with the native breed. Of late years too the English Suffolk Punch has been tried, not without success, and quite recently the Boulonnais, French brother of the Percheron, has been introduced and promises to become popular. The Belgian breed has only been tried to a limited extent, but has so far given satisfaction and it appears destined to play an increasingly important part in the agriculture of the Argentine.

Cattle. — Of all the branches of animal husbandry none has taken the same advantage of the astonishing economic development of the country as cattle rearing. The second half of the nineteenth century with its extensive imports of the best European breeds and gradual elimination of the native Criollo strain represents a period of the great transformation in the Argentine cattle. In the case of cattle also, England is the great purveyor of improved stock, the part played by other countries being insignificant. The supremacy of England as a source of supplies is ensured by the special Argentine National Law, No. 4155, completed by some decrees, especially those of January 9 and 16, 1903, which forbid the importation of cattle, sheep and goats from any other European country.

Of all breeds the Shorthorn, or, as it is generally known in the Argentine, the "Durham", is the most widely spread. It is especially suitable for crossing with the native Criollo cattle and is considered now as the impro-

ver *par excellence* of the Argentine cattle. The next in favour, but making a bad second, is the Hereford, which, in spite of great exertions on the part of its partisans, is in no great demand.

The third English beef type is the Aberdeen Angus, representatives of which are not very numerous and mostly met with in the south-western district. Perhaps this breed will spread more when the herds of the country are further improved so that it has a chance of revealing its great quality of producing valuable beef animals when crossed with other pure breeds.

No other breed has hitherto acquired any importance in the Argentine, neither the small English beef types nor milch cattle, the latter probably on account of the edict prohibiting the importation of cattle mentioned above. Among the best known milk breeds, Flemish and black and white Lowland cattle have been in the country for the last twenty years; Jerseys and Ayrshires have not become very popular owing to their lack of size and weight. The beef-producing types are by far the most prevalent, and give the cattle of the country a character of great uniformity. Argentine, with its great estancias and its herds running into thousands of head, is eminently adapted to the production of fat beef on its immense pastures.

Sheep. — The importation of improved European sheep began in the first half of the nineteenth century. The first object being to obtain a finer wool, imports from Spain were gradually abandoned in favour of imports of improved sheep from Germany, because breeders in that country have from the beginning devoted themselves to the production of fine wool. In 1836 and 1837 about 4 200 Saxon Elector and Negretti sheep were imported from Germany alone. At first the Electors were the most popular, but, owing to the lack of development of the crossbreds, after 1838 preference was given to Negrettis, which are larger and produce more wool, Germany continuing to be the chief source of supplies. Rambouillet sheep made their first appearance in the country in 1845, but it was only in 1870 that France caught up and passed Germany as a source of supplies, without however attaining very high figures. Vermont sheep were also tried, but without much success. The repeated severe crises in the wool trade, and the enormous increase in the number of sheep led the estancieros to seek to make sheep farming more profitable by utilizing skins and tallow in the "saladeros" (salt meat factories) and "grasieras" (tallow factories). Consequently size and condition of the sheep became more important and the larger and heavier Rambouillet breed was preferred. Meanwhile the increasing exports of live animals and frozen meat, together with the fact that even the somewhat coarser wool of the crossbreds found a sale on the markets, led to a demand for sheep which produced good mutton. In this way English breeds gradually replaced the fine-woolled types of France and Germany, and imports of these breeds soon became considerable. While England had exported to Argentine only 625 sheep for breeding purposes between 1863 and 1880 against 3269 from France and Germany in the next five years, 1881-85, the English sheep numbered 2759 against 1895 French and German.

Lincoln sheep were the favourites and were largely employed for crossing with Merinos, so that after a few years their crosses formed the bulk of the Argentine flocks; they stocked the rich natural pastures in the province of Buenos Aires, while the Merino sheep were driven into the dry lands of the Central Pampas and of the south. There are still some first class Merino farms in the province of Buenos Aires, but the mass of Merinos are now in the above districts. From the Central Pampas the Merinos have spread gradually southwards to the Rio Negro, Santa Cruz and Patagonia. The common Merinos thrive especially well in Patagonia, which has become an excellent sheep raising country of late years, but which can only attempt to produce very high class wool on account of its great remoteness and consequent transport difficulties.

Romney Marsh sheep are at present found only to a limited extent, but seem to have a future before them in the Argentine. New Leicesters, Cotswolds and Cheviots have also been imported, but have not attained any importance; neither have the Down breeds made much progress, probably owing to the coarseness of their wool.

Pigs. — Pig rearing is still in its infancy in the Argentine owing to the present conditions of land tenure and to the small and uncertain market. It is relatively more developed in the more densely populated agricultural districts, especially where much maize is grown.

Goats. — Goats are not numerous in the Pampas, owing to the predominance of sheep. They are more important in the mountainous parts of the Republic where they often represent a valuable source of income for the small farmer. Their most remunerative product is their skins, which command good prices, especially the kid skins.

Poultry. — Poultry keeping is also in a very undeveloped condition in the Argentine.

In a special chapter the writer treats of the work of the "Sociedad Rural Argentina" (the Central Agricultural Association of the Argentine) and of the International Agricultural Exhibition of 1910. A further chapter is devoted to the utilization of animal products in the Argentine (salting of meat, exportation of live animals and cold storage).

Utilization of animal products. — At present the production of cold stored and frozen meat are the most important methods of utilizing animal products.

In 1882 Drabble Bros. erected the first cold storage plant in the Argentine, and were soon followed by Sausinena and Son. At first only mutton was treated, beef coming later. Exports began in 1883 with the limited figure of 17 165 head; in 1885 the number was 108 823, in 1886, 434 699 and three years later it was upwards of a million. Since then the industry has developed rapidly, having been much assisted by the State.

At present the cold storage industry in the Argentine employs upwards of 7000 hands, and its working capital amounts to about £10 000 000. While in 1887 the value of the salted meat was 48 per cent. of that of the total quantity of animal produce exported, twenty-three years later it sank to less than 2.5 per cent. On the other hand cold-stored beef, which was ninth

on the list in point of importance in 1887, now occupies the first place. In the place of jerked beef (*asajo*) more valuable products have appeared and the total value of exports has risen uninterruptedly and sometimes with great rapidity.

The price of refrigerated and frozen meat delivered on board at Buenos Aires is as follows :

	Price per lb.
Frozen beef	2.83 <i>á</i>
Refrigerated beef	3.37 "
Frozen mutton	3.79 "
Freight to London and Liverpool :	
Frozen meat	0.37 "
Refrigerated.	0.51 "

Dairying. — The total number of dairying firms in the Argentine has risen from 324 in 1903 to 896 in 1909, but the whole industry is still in its early stages. Really intensive dairying does not yet exist and cannot exist, the large open grazing tracts and the lack of suitable labour as well as the thin population making the country in its present condition unsuitable for the development of the industry.

The milch cows are mostly crossbred Shorthorns and are milked in a rather primitive fashion, often only once a day, in the morning after they have suckled their calf. The yield of milk is low, at most 1.54 to 1.76 gallons during the first period of lactation and 0.44 to 0.66 gals. per day on an average. Breeding for milk is as yet scarcely known in Argentine, and would be hardly justifiable at present.

Of late the Government has seemed disposed to pay more attention to the question of dairying, and the recently founded "Oficina de Industria Lechera y Refrigeracion," which forms part of the Ministry of Agriculture, is beginning to show much activity. On its initiative the first milk control association has been instituted at Germania ("Sociedad de Contralor de la Produccion lechera de Germania") with help from the River Plate Dairy Company (a large company of English and Argentine capitalists), which possesses in the provinces of Buenos Aires, Santa Fé, Cordoba and Entre Rios 45 creameries driven by steam and a capital of 500 000 pesos gold (£ 102 940). It makes butter, cream, and casein, and raises pigs in the butter factories (*mantequeras*) of Buenos Aires, Rosario, Santa Fé and Basavilbaso (Entre Rios).

A concluding chapter contains a description of typical farms and an extensive bibliographical review is given in the form of an appendix.

AGRICULTURAL
SHOWS AND
CONGRESSES

491 — **Agricultural Shows.**

Belgium.

1914. Oct. 24-26. Louvain. — Second International Poultry Show, organized by the "Aviculteurs de Louvain".

France.

1914. Oct. 1-4. Angoulême. — General show of horticultural products and of the arts and industries depending on horticulture, organized by the "Société d'Horticulture et de Viticulture de la Charente". M. Lotte, 98 rue de Bassau, Angoulême.

Dec. (2nd half). Paris. — Twenty-fifth Poultry Show of the "Société nationale d'Aviculture de France".

Germany.

1915. (Summer). Breslau. — Annual show of the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft).

March 19-21. Magdeburg. — Third fat stock show; will include also rabbits, agricultural machines, butcher's tools and foodstuffs.

Hungary.

1914. September. Budapest. — Show of agricultural machines, organized by the "Köztelek" Agricultural Society of Budapest.

Norway.

1914. Sept. 20-28. Christiania. — Exhibition of agriculture, mechanical cultivation and domestic economy, held during the Norwegian Centenary Exhibition (May 15-Oct. 15).

Russia.

1914. Sept. 18-Oct. 4. Rostov-on-the-Don. — Agricultural and industrial show, organized by the Imperial Agricultural Society of the Don-Kuban-Terck.

Spain.

1914. July-October. Tortosa. — International Exhibition of Agriculture, Viticulture and Hygiene.

492 — Agricultural Congresses.

France.

1914. Nov. 3-6 (probable date). Melun (Seine-et-Marne). — Nineteenth Annual Congress of Chrysanthemists, held by the "Société française des Chrysanthémistes". At the same time the "Société d'Horticulture de Seine-et-Marne" will organize a show of all horticultural products.

Dec. 4-5. Paris. — First National Congress on Agricultural Labour, organized by the "Société nationale de protection de la main-d'œuvre agricole." There will be six sections: 1) Legislation on rural wages and insurance. 2) Popular agricultural instruction. 3) Credit on property, housing, hygiene. 4) Labour exchanges. 5) Minor agricultural industries. 6) Métiage and various lease contracts.

Italy.

1914. August (end). Genova. — International congress on the wine trade, held by the local committee, in agreement with the presidency of the International Committee on the Wine Trade (Paris). There will be two long excursions, one to the vermouth districts and the other to Marsala.

CROPS AND CULTIVATION.

493 — **Determination of Air Temperatures.** — HELLMANN, G. in *Bericht über die Tätigkeit des Königlich Preussischen Meteorologischen Instituts im Jahre 1913*, pp. 46-51. Berlin, 1914.

AGRICULTURAL
METEOROLOGY

Two aspiration thermometers (Aspirationsthermometer) were set up 1.5 metres (5ft.) apart in a meadow belonging to the Meteorological Observatory at Potsdam. One was one metre (3 ft. 3 in.) from the surface of the grass, which was kept closely mown, and the other was two metres (6 ft. 6 in.). Readings were taken by means of a telescope every second, usually for periods of ten minutes. From the results obtained, the writer drew the following conclusions:

1. On days of active radiation, the temperature of the air at midday may vary from 1° to 1.5° C. (1.8° to 2.7° F.) per minute at a distance of one and two metres from the surface of the soil. Changes of 0.4° or 0.5° C. (0.7° or 0.9° F.) in 10 to 15 seconds are not infrequent.

2. Variations of temperature during the hours of strongest sunshine (i. e. 7 a.m. to 1 p.m.) are greater at one metre from the surface of the ground than at two metres.

3. Usually during those hours, the temperature is higher at one metre than at two metres from the surface, but frequently this order is reversed, showing the presence of both ascending and descending currents of air.

4. In the early part of even hot days in summer (7 a.m. to 9 a.m.) large variations are rare, and during the colder months of the year the thermometer hardly varies 0.05° C. in several minutes.

It follows from the above conclusions that a single reading on days when radiation is very active is likely to give erroneous results and should be replaced by the mean of a large number of readings taken at frequent intervals. On the other hand one single reading will be sufficient on cloudy or windy days. Further, two metres is a better height at which to place thermometers than one metre, as violent fluctuations of temperature due to radiation and reflexion from the soil are less noticeable at two metres than at one. It would appear, therefore, that the English practice of placing thermometers at 4 feet from the surface of the ground would not give such good results as that observed in other countries of placing them at 6ft. 6 in.

494 — **Chemical Composition of Rain in South Africa.** — JÜRITZ, C. F. in *The South African Journal of Science*, Vol. X, No. 7, pp. 170-193. Capetown, March 1914.

These determinations of the chemical composition of rain in South Africa were begun in 1910 as part of the scheme for the examination of

TABLE I.

Locality	Period	Total rainfall in inches	Pounds per acre			
			Nitrogen			Chlorine
			as ammonia	as nitrates	total	
Grahamstown .	Aug. 1911 to July 1912	26.59	1.030	0.726	1.756	23.38 (1)
" "	Dec. " to Nov. "	22.14	0.858	0.735	1.593	23.63 (2)
Kokstad . . .	Jan. 1912 to Dec. "	26.54	1.118	0.670	1.788 (3)	—
Bloemfontein .	Sep. 1910 to Aug. 1911	27.82	3.658	1.620	5.278	6.72
" "	Sep. 1911 to Aug. 1912	15.49	4.870	1.363	6.233	2.31 (4)
Durban . . .	Jan. " to Dec. 1911	42.34	3.651	1.234	4.885	61.16 (5)
" "	Jan. 1912 to Dec. 1912	31.07	3.906	1.249	5.155	70.40
Cedara . . .	" " " " "	26.68	4.710	0.865	5.575	16.17 (6)

(1) Not including Aug. and Dec. 1911, and May 1912. — (2) Not including Dec. 1911, and May and Aug. 1912. — (3) Excluding 0.25 inch of rain during Sept. 1912. — (4) Not including March 1912. — (5) Excluding 0.2 inch of rain during June 1911. — (6) Excluding 0.1 inch of rain during June 1912.

rainfall in all parts of the world initiated by Dr. MILLER. The determinations were carried out at 8 stations, adopting uniform methods of collecting and analysing the rainwater. Precautions were taken to prevent contamination by dust and by the excreta of birds.

The results obtained are summarised in the tables (I and II):

TABLE II. — *Comparison of nitrogen content of summer and winter rains.*

Locality	Period	Nitrogen in pounds per acre					
		Summer: Sep. to Feb.			Winter: March to Aug.		
		as ammonia	as nitrates	total	as ammonia	as nitrates	total
Grahamstown.	Sep. 1911 to Aug. 1912	0.592	0.465	1.057	0.448	0.264	0.712
Bloemfontein.	» 1910 to » 1911	1.425	0.907	2.332	2.233	0.713	2.946
»	» 1911 to » 1912	3.244	1.077	4.321	1.626	0.286	1.912
Durban. . . .	» » » » »	2.739	0.780	3.519	1.796	0.295	2.091

Table II shows an increase of nitric nitrogen during the summer months. During 1910-11 considerably more nitrogen was brought down as ammonia at Bloemfontein in winter than in summer, but during the following year this irregularity disappeared.

495 — **The Red Clay Soil of Porto Rico.** (1) — GLE, P. L. and AGETON, C. N. — *Porto Rico Agricultural Experiment Station, Bulletin No. 14*, pp. 1-24. Washington, March 1914.

SOIL PHYSICS
CHEMISTRY
AND
MICROBIOLOGY

The red clay is one of the most widely distributed types of soil in the island of Porto Rico. It is a fairly heavy clay resting on an impervious subsoil, and contains a high percentage of iron and aluminium but no carbonates, being almost invariably acid and deficient in organic matter. Usually it responds to manuring and more especially to applications of lime, but certain areas, which have been continuously under sugarcane, are in a "sick" condition and respond neither to manuring nor to liming. The reason for this condition is unknown, and the results of analyses of the organic matter of these soils carried out by the U. S. Department of Agriculture failed to account for the observed facts.

496 — **Methods in Soil Bacteriology, VII: Ammonification and Nitrification in Soil and Solution.** — LÖHNIS, F. and GREEN, H. H. (Laboratorium für Bakteriologie am Landwirtschaftlichen Institut der Universität Leipzig) in *Centralblatt für Bakteriologie etc., II Abt.*, Vol. 40, No. 19/21, pp. 457-479. (Article written in English). Jena, April 4, 1914.

In a series of ammonification trials the influence of aeration on the process was investigated by using different depths of liquid medium, blood meal being the basis of the nitrogen supply. It was found that this factor had less importance than was expected, and that the low ammonification

(1) See No. 100, B. Feb. 1914.

of substances in deep layers, such as has been previously noted, could only be due in part to the anaerobic conditions prevailing. In a second set of trials, the decomposing material was not only placed in a liquid medium but also distributed over various solid media, such as soil, sand, glass sand, glass wool, and this factor of distribution appeared to be of considerable importance, as ammonification was always more active when solid media were employed than it was in a liquid medium.

Nitrification trials showed that the activity of this process in liquid media decreases as the depth of the medium increases, and when the solution was spread out in a film 2 mm. thick, the results were similar to those obtained when soil was used as medium. The concentration of the ammonia in the liquid medium appeared an important factor, equal amounts of nitrate being formed with 0.1 per cent. ammonium sulphate and 0.1 and 0.3 per cent. magnesium ammonium phosphate ($\text{Mg NH}_4 \text{PO}_4$) but the amount being reduced when 0.2 per cent. ammonium sulphate was used. The presence of basic magnesium carbonate proved distinctly inhibitive.

- 497 - **The Absence of Nitrate Formation in Cultures of Azotobacter.** — KELLERMAN, K. F. and SMITH, N. R. (U. S. Department of Agriculture, Washington, D. C.) in *Centralblatt für Bakteriologie etc., II Abt.*, Vol. 40, No. 19/21, pp. 479-482. (Article written in English). Jena, April 4, 1914.

Recently there has appeared a report (1) of observations upon certain cultures of species or varieties of Azotobacter recording the formation of nitrate, presumably resulting from the activity of the cultures under discussion. Professor Jones supplied the writers with cultures of four strains which he considered to possess the ability of forming nitrate; these were grown in Ashby's solution both with and without the addition of potassium nitrate, and at stated intervals careful examinations were made both for the presence of nitrate and for the gain in total nitrogen due to the fixation of atmospheric nitrogen. The results indicated clearly that while these strains were capable of fixing appreciable quantities of free nitrogen they were apparently unable to produce nitrates.

- 498 - **The Mechanism of Denitrification.** — HULME, W. (Manchester University), in *Journal of the Chemical Society*, Vols. CV and CVI, No. 617, pp. 623-632. London, March 1914.

Four flasks of culture media were prepared, containing respectively :

I	2	3	4
Peptone . . 0.5 %	Peptone . . 0.5 %	Peptone . . 0.5 %	Peptone . . 0.5 %
Meat extract 0.5 %	Meat extract 0.5 %	Dextrose . . 0.5 %	Dextrose . . 0.5 %
Pot. nitrate . 0.5 %		Pot. nitrate . 0.5 %	

and were inoculated with pure cultures of denitrifying organisms isolated from dried sewage filter deposit. The gases formed by the fermentation

(1) JONES, D. H., A morphological and cultural study of some Azotobacter. — *Centralblatt für Bakteriologie, II Abt.* Vol. 38, pp. 14-25, 1913.

were collected, measured and analysed. After 20 days they had the following composition :

Flask	cc. of gas formed	Hydrogen %	Nitrogen %	Carbon dioxide %
1 } Containing nitrate	39	—	98.83	3.17
3 } Containing nitrate	36	—	98.59	1.41
2 } Containing no nitrate	26	70.14	—	29.86
4 } Containing no nitrate	53	73.17	—	25.83

Flasks 1 and 3 were also shown to contain nitrite.

From these results it would appear that reduction of nitrate is brought about by the action of nascent hydrogen, for though hydrogen is the chief constituent of the gas evolved from flasks 2 and 4, which contain no nitrate, in the presence of nitrate the gas of fermentation consists almost solely of nitrogen. This conclusion was confirmed by another experiment in which the medium fermented contained a weaker solution of nitrate (0.1 per cent.). So long as nitrite was present in the fermenting solution the gases formed consisted of nitrogen and carbon dioxide, but as soon as reduction was complete and nitrite could no longer be detected in the fermenting solution, then the gases formed consisted of hydrogen and carbon dioxide.

In order to determine whether enzymes played any part in denitrification, sterile enzyme solutions were prepared from the four above culture media. The media were precipitated with alcohol and salt, and the precipitate was dried, redissolved, and filtered through a Chamberland filter candle. A few cc. of these enzyme solutions were then added to tubes containing 5 cc. of a 1 per cent. solution of potassium nitrate and incubated for 24 hours, after which the nitrate present was estimated quantitatively :

Flask	Mgm. of nitrogen as nitrite		
	Nitrate sol. alone	Enzyme sol. alone	Nitrate + enzyme sol.
1	0.005	0.01	0.03
3	0.005	—	0.02
2	0.005	—	0.01
4	0.005	—	0.01

These results seem to show that the denitrification of a medium containing nitrates and peptone under anaerobic conditions yields an enzyme

which has the power of reducing a 1 per cent. solution of potassium nitrate. The reduction obtained with the enzyme solutions from flasks 2 and 4 was probably due to a purely chemical reduction of the nitrate by the organic matter present in the solution.

Further enzyme solutions were prepared from a nitrate broth undergoing denitrification: *a*) after the fermentation had progressed for four days and the culture medium contained a considerable quantity of nitrite, and *b*) when the fermentation was complete and all the nitrate and nitrite had been decomposed; both were tested for enzyme action as before and the results showed that the denitrification of nitrate broth under semi-aerobic conditions involved the production of an enzyme as long nitrate or nitrite were present in the solution, but that the enzyme disappeared when the nitrate and nitrite had been decomposed.

Finally, other enzyme solutions were prepared from culture media, some of which had been inoculated with denitrifying organisms while others had remained sterile, in order to determine whether the reducing product isolated from denitrifying solutions was really due to bacterial influence, or whether it would also be produced in a flask containing similar ingredients and treated in exactly the same way, but which all the while remained sterile. The enzyme solutions were tested as before and the results definitely showed that the reducing product was due entirely to bacterial action and was not a purely chemical product.

499 - **The Functions of the Non-Bacterial Population of the "Bacteria Bed."**

— CRABTREE, J. (Manchester Sewage Works, Withington) in *Centralblatt für Bakteriologie Abt. II*, Vol. XL, No. 11/13, pp. 225-239. Jena, March 2, 1914.

Three experimental contact filter beds were prepared as follows: the socket ends of three earthenware sewer pipes, 2ft. 6in. long by 6in. in diam., were filled with concrete to form a bottom, and a hole was bored at the base of each to form an outlet. They were then filled with clinker, 0.25 in. to 0.75 in. in size, and received the effluent from the settlement tank twice daily except Saturdays and Sundays when only one filling was given; the contact lasted two hours each time. Of the three beds, A served as control, B was subjected repeatedly to partial sterilization by filling the tank with a saturated solution of toluene in water, and C was at first run as a duplicate of A but later was also tolued. The beds were occasionally, and the effluents constantly, subjected to analysis, chemically by the estimation of free ammonia and nitrates and by the oxygen absorption test, and biologically by the plating out of bacteria on gelatine and by counting protozoa by means of a plankton counting chamber. Further, a preliminary set of experiments showed that the bacterial content of the effluent varied with that of the bed medium and could therefore be used to indicate the bacterial condition of the latter without continual disturbance of the bed.

During the first two months the beds all received the same treatment and the analyses showed that the three beds were similar in every respect. On the 67th day from the start B was tolued for the first time. The

effect of this on the effluent was first a drop, then a large increase in the number of bacteria growing on gelatine, and a decrease of the percentage purification. The bed, however, recovered comparatively quickly and was practically normal again at the end of a week. The treatment was repeated at intervals varying from 7 days to 3 weeks, always with the same results, the effluent from B never reaching the same degree of purification as that from A. After eight months, B produced for the first time an effluent better than A. This occurred 56 days after previous toluene treatment and from that time forward the superiority of B's effluent was maintained in spite of repeated treatment with toluene.

At the end of the 13th month the protozoa in B were reduced to 760 per cc. of the bed medium, while A contained 2240 per cc., but a series of bacterial counts carried out during the 12th and 13th months indicated that the number of bacteria in the effluent from B was only slightly higher than the number in the effluent from A. It was therefore difficult to attribute the superiority of B over A to the increase of bacteria owing to the removal of the animal population. When, however, the capacities of the two beds were compared, a considerable difference was observed between A and B. While the original capacity of A had only been reduced 7.06 per cent by the 13th month, that of B had been reduced 15.7 per cent, and the difference of the surface deposit on the clinkers was evident to the naked eye, that of B being moister and more spongy, while that of A was more granular. But this very reduction in capacity and change in the character of the surface deposit, which may be ascribed to the removal of the animal forms, would improve the purity of the effluent by increasing the surface of the bed, and would consequently account for the superior results given by B over A.

During the 13th month, C as well as B was tolued, and confirmed the results obtained with B at the start. In a last set of experiments, when the tank effluent was replaced by a dilute peptone solution (1 part of albuminoid ammonia per 100 000) in order to eliminate the effect of the continual addition of extraneous organisms and colloid matter, the tolued bed C showed greater purification than the untreated bed A, while, at the same time, the capacity of A increased and that of C did not, owing to its animal population attacking and removing the solid deposit.

Thus the animal population of a contact bed helps to keep the latter open and from this point of view is desirable, but outside this effect it seems to have little influence on the actual purification processes taking place. The increased number of bacteria capable of growing on gelatine which were present in the beds after toluene treatment was not correlated with a higher degree of purification, and the writer suggests that counts on nutrient gelatine do not necessarily indicate the number of bacteria involved in the purifying processes, for growth on gelatine is chiefly a putrefactive process, while purification is chiefly an oxidation process. In this connection, the work of MÜLLER is referred to, where it is shown that protozoa in water reduce the number of bacteria capable of growing on gelatine, but do not affect those growing on albumose agar; from this the conclusion is drawn that protozoa prey only on bacteria foreign to water (*B. coli*,

B. typhosus, etc.) and leave the normal population untouched. Applying this idea to the case of sewage, very suggestive results were obtained by plating effluents simultaneously on gelatine and albumose agar, when the order of the counts obtained from beds A and B was reversed. The writer only puts forward this explanation tentatively, as the experimental evidence on which it is based is still very slight; but according to it, the removal of protozoa would not only reduce the capacity of a bed but would also tend to decrease its power of purification by allowing the increase of the putrefactive organisms and a consequent decrease of the normal population, the better results obtained with B than with A after eight months being solely attributed to the increased surface of bed B. But in any case, the continual addition of sewage rich in all classes of bacteria must tend to keep the population fairly stable and tend to nullify any selective effect which the protozoa may possess.

MANURES AND
MANURING

500 - **The Manurial Value of Phonolite** (1). — NEUMANN, R. in *Fähling's Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 278-291. Stuttgart, 1914.

It has already been demonstrated by a number of pot and field experiments that phonolite possesses a certain manurial value, which, however, cannot be compared with that of the common potash manures, because of its insolubility, and the use of ground phonolite has therefore been deemed inadvisable owing to its high price and limited efficiency.

In 1912 a new phonolite appeared on the market, the "Vulkan-phonolith", which was claimed to be more valuable than those previously known and to possess the property of fixing nitrogen. In spite of repeated warnings against it from competent quarters it succeeded in gaining a footing in several countries. In order to give greater weight to its warnings, the Experimental Station of Hohenheim started a series of pot and field experiments with the new phonolite in the autumn of 1912. The investigations were planned: 1) to compare the values of phonolite and kainit as potash manures by the addition of kainit on the one hand and of phonolite on the other to a fundamental manuring of basic slag and nitrate of soda; and 2) to ascertain the existence of the alleged nitrogen-fixing property by comparing an unmanured soil with one treated with phonolite. The plants used were winter and spring barley and mangolds. The fertilizers used had the following composition:

Vulkan-phonolith:

- 7.3 per cent. total potash (soluble in hydrofluoric acid).
- 5.0 " " potash soluble in hot concentrated hydrochloric acid.
- 0.4 " " potash soluble in hot water.

Kainit: 15.1 per cent. K_2O .

Basic slag: 16.3 per cent. citrate soluble P_2O_5 .

Nitrate of soda: 15.3 per cent. N.

(1) See also: No. 233, *B. March* 1913; No. 349, *B. April* 1913; *B. Oct.* 1913, p. 1483; original article by Prof. LEMMERMANN: On the Possibility of Replacing Stassfurt Potash Salts by Finely Ground Phonolite, Leucite, etc.

The writer summarizes the results of his experiments and observations as follows:

1. The affirmation that "Vukaln-phonolith" possesses the property of nitrogen fixation has not been confirmed by either the pot or the field experiments.

2. In the barley field the only effect of phonolite was to increase the yield of straw; this increase, however, was greater when the same amount of potash was given under the form of kainit.

3. In these same experiments kainit also gave a large increase in the yield of grain.

4. With mangolds, phonolite produced a heavier crop of roots, but the increase was only apparent, for on examining the amount of dry matter in the crop it was found that there was no real increase. With an equal amount of potash given as potash salts the yield of dry matter was considerably higher.

5. The experiments have failed to prove any superiority of "Vulkan-phonolith" over the other phonolite.

501 - **New Investigations with Magnesium.** — MIEGE, E. and COMPAIN, E. in *La Vie agricole et rurale*, Year III, No. 19, pp. 532-533. Paris, April 11, 1914.

Applications of dolomite (having a lime - magnesia ratio of 1.5) were made as follows on plots 0.6 acre in area:

Plot 1. — Raw dolomite at the rate of $6\frac{1}{2}$ cwt. per acre.			
Plot 2. — Roasted dolomite	"	"	"
Plot 3. — Lime	"	"	"
Plot 4. — Control.			

The soil was a clay loam having the following percentage composition :

	Soil	Subsoil
Nitrogen	0.18	0.16
Phosphoric acid	0.21	0.20
Potash	0.13	0.09
Lime	0.86	0.65
Magnesia	—	0.35
Iron	4.61	4.89
Organic matter	1.71	1.49
Coarse sand	31.01	32.26
Fine sand	59.58	56.17
Clay	8.53	10.67
Humus	1.28	1.19
Reaction	alkaline	neutral

The manure was hand sown and harrowed in. The land was then ploughed a second time and tankard mangels were sown on June 25. The latter were harvested on October 29 and yielded the following weights per acre.

Plot 1. — Raw dolomite	25 tons
Plot 2. — Roasted "	26.5 "
Plot 3. — Lime	28.5 "
Plot 4. — Control	27.5 "

These results show that the dolomite had a distinctly depressing effect on the yield.

AGRICULTURAL
BOTANY.
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

502 - Report of the Imperial Economic Botanist for India, 1913. (1) — HOWARD, A. in *Report of the Agricultural Research Institute and College, Pusa, 1912-13*, pp. 26-52. Calcutta, 1914.

Wheat Experiments.

The improvement in the quality of Indian wheats has now reached the practical stage and extensive seed farms have been established for the distribution of high grade seed to the public. Mr. Humphries, of the Incorporated Society of British and Irish Millers, reports that these Pusa wheats produce good baking flours equal to those of the Manitoba spring wheats. At the same time both cultivators, landholders and the educated community in India prefer them to their own indigenous varieties.

Experiments in different localities in India have shown that these improved varieties retain their superior qualities whether grown on alluvial soils under irrigation or on the black cotton soils of the Deccan.

Further experiments are in progress with the object of producing strains of Pusa wheats with increased standing power, rust resistance and general hardness.

Other Investigations.

Tobacco. — A type of tobacco has been found in Bihar suitable for cigarettes. It is known as Type 28 and seed is now being distributed to planters and Government farms in the Central and United Provinces. Partial sterilisation of the seed beds by surface fires has given excellent results in preventing loss of first sowings and seedlings.

The inheritance of characters has been studied and several promising strains have been isolated. It has been shown that the inheritance of such quantitative characters as size and shape of leaf follow Mendelian laws.

Gram (Cicer arietinum). — The selection experiments have been continued. The high yielding white strain again gave good results at Pusa and is being tried on the Government farms in the Central and United Provinces.

Fibres. — The study of the inheritance of characters in *Hibiscus Sabdariffa* is being continued. A promising strain of *H. cannabinus*, known as type 3, has been grown for fibre with satisfactory results, and seed will be distributed during the season.

Indigo. — This work has been transferred from the Sirsiah Experiment Station to Pusa. Two problems await solution, *viz.* methods of

avoiding loss of plant due to "wilt" during the late monsoon, and the production of a reliable seed supply in Bihar. The methods of pollination will also be studied with a view to applying modern methods of selection and breeding. Already valuable results have been obtained on the successful treatment of "wilt" and these will be published during 1914.

Development of the Fruit Industry in Baluchistan.

The raising of nursery stock and economy in the use of water for irrigation purposes has been effected. Clover as a green manure has given excellent results. A collection of the most useful varieties of trees from the south of France is being made with a view to future developments.

Tomato cultivation is being attempted on a large scale, the plants being trained on the two-branch system combined with furrow irrigation.

Experiments on the packing and transport of fruits are also being carried out.

503 - **Research on Vegetable Physiology: III and IV.** (1) — MAZÉ, P. in *Annales de l'Institut Pasteur*, Vol. 27, No. 12, pp. 1093-1143; Vol. 28, No. 1, pp. 21-26. Paris, December 25, 1913, January 1914.

The functions of water. — In a perfectly balanced culture solution, the volume of water transpired by the maize plant in producing a given quantity of dry matter is constant and independent of the concentration of the salts in solution. The addition of assimilable organic matter diminishes transpiration, and, in the case of sugar, the amount of dry matter in the plant is increased. In an unbalanced solution, an increase in the concentration of calcium nitrate from 0.5 to 1.0 per cent., or of calcium chloride from 0.5 to 2.0 per cent., lowers the rate of transpiration, whilst ammonium nitrate and potassium phosphate in excess, increase it.

The rate of transpiration by day is independent of that by night, but after a low temperature in the day-time the nocturnal rate of transpiration is more rapid. The rate of transpiration is also greater during the second half of the night than during the first. Other workers have observed a greater rate of transpiration in plants growing in poor soils, owing to the extension of the roots in the rapidly impoverished soil.

The mechanism of absorption. — In nature the soil solution is never physiologically balanced for the needs of the plants, and only those which ripen all their seeds at a definite period are able to complete the ripening process in an exhausted solution. Leguminous plants generally show all stages of development at the same time and require a nutritive solution of constant strength. Their roots are therefore sensitive indicators of the condition of a culture medium. In dilute solutions they develop luxuriantly, whilst in unbalanced solutions they grow to an abnormal length and the leaves do not develop at all.

The root is protected against the entrance of soluble substances by the presence of a mucilaginous sheath.

Secretory functions of roots. — The acid reaction of the excretions of roots would be favourable to diastatic action, but though soluble starch

(1) See No. 3108, B. Nov.-Dec. 1911; No. 19, B. Jan. 1914.

in a culture solution may be absorbed by roots, there is no evidence of the formation of invert sugar in the medium. Saccharose in culture medium is partially converted into invert sugar, but sucrase cannot be detected. The leaves and stem contain 78.9 per cent. of invert sugar. It therefore appears that saccharose is absorbed as such, inverted in the leaves and returned to the roots to be excreted as invert sugar.

Conditions of fructification in aseptic solutions. — In 1911, fructification was only obtained in cultures containing sodium nitrate. Under other conditions, the plants appeared to be disturbed during the development of the reproductive organs; several female ears were produced, the majority of which aborted. During the migration of reserves to the fertilised ovaries the composition of the nutritive solution requires to be changed to meet the requirements of the plant.

THE INFLUENCE OF MINERAL SALTS ON THE GROWTH OF MAIZE.

The solutions were made with ordinary tap-water, since fructification does not take place in distilled water owing to the absence of traces of certain substances. The influence of calcium carbonate, sulphur, iron, manganese and zinc was studied.

Calcium carbonate. — When calcium carbonate is replaced by calcium chloride in culture solutions containing ammonium salts, the roots show abnormal development and the medium develops an acid reaction. If the nitrogen is supplied as sodium or ammonium nitrate, the medium becomes alkaline and abnormal root development takes place. It is therefore necessary that calcium should be present in the form of carbonate. The quantities of iron, manganese, and zinc present in culture solution would be fatal if supplied as pure solutions in distilled water. They are precipitated by the calcium salts in the culture solution and are only rendered soluble gradually as the culture solution becomes acid or alkaline.

Influence of sulphur and iron. — In the absence of sulphur and iron, plants gradually develop chlorosis and become sterile. A drop of solution containing iron or sulphur placed on the discoloured leaves restores the green colour and the functions of the chlorophyll.

Influence of manganese. — The difficulties of depriving a plant of manganese owing to its presence in glass and in the seeds, diminishes the chlorotic effect of its absence from the solution. Solutions of manganese do not restore the discoloration due to manganese chlorosis, but the sap of normal maize plants appears to contain some specific substance which restores the chlorophyll function.

Influence of zinc. — In the absence of zinc, the roots become covered with a yellowish deposit of sulphur. The leaves gradually darken, take on a metallic appearance and become incrustated with mineral matter causing the death of the plant.

Pure solutions of nitrate, phosphate, sulphate and chloride of soda, potash and lime are only favourable to growth in concentrations between

0.5 and 0.1 per cent. Ammonium salts of the same acid radicles are not tolerated at concentrations exceeding 0.5 per cent.

Calcium nitrate appears to favour the development of long roots, thus making a greater depth of soil available to the plant.

504 - **The Resistance of Leguminous Seeds to High Temperatures.** (Publication of the Faculty of Natural Science of the Royal Hungarian Academy of Agriculture at Magyaróvár). — NEUBERGER, F. in *Kísérleti Kéziratok*, Vol. 17, No. 1, pp. 121-168 (pp. 169-170, German abstract). Budapest, January-February 1914.

The experiments were made with seeds of *Vicia Faba*, *Vicia sativa*, *Phaseolus vulgaris*, *Pisum sativum*, *Lens esculenta*, *Medicago sativa* and *Trifolium repens*. The seeds were submitted to the action of dry heat at a temperature of 50° to 130° C. for from ½ hour to 6 hours, and to the action of warm water at a temperature of 45° to 100° C. during ½ hour to 2 hours. They were then germinated in a Weinzierl apparatus. The results are summarised in Tables I and II.

The effect of heat on germination is proportional to its intensity and duration. Up to a temperature of 80° C. dry heat acting for a certain length of time is not injurious to germination. Above 80° C. the resistance of the individual seeds of different varieties varies considerably. For any given species the resistance to heat is inversely proportional to the water content of the seeds, and may be increased to some extent by careful drying. The highest temperature to which leguminous seeds have been subjected without destroying their germinating power is 130° C. Immersion in water at a temperature higher than the maximum temperature of germination has no injurious effect if the immersion takes place before the seeds begin to swell. The relative resistance of different species may be considered a special characteristic of each species.

According to the writer the injurious action of heat is due to the destruction of enzymes which control the germinating power of the seed. Further researches are being made on this subject.

TABLE II.
Influence of warm water on the germinating power of leguminous seeds.

	Initial germination capacity %	Duration of treatment in hours:												Total of percentage germinations							
		Percentage germination																			
		45°	50°	55°	60°	65°	70°	75°	80° c.												
		1	2	1	2	1	2	1	2	1	2	1	2								
Broad beans (<i>Vicia Faba</i>)	100	99	98	97	72	60	0	39	0	66	45	0	33	17	0	13	4	0	3	0	646
Harrow beans (<i>Phaseolus vulgaris</i>)	98	100	89	26	0	4	0	1	0	12	0	0	0	0	0	0	0	0	0	0	232
Peas (<i>Pisum sativum</i>)	96	94	78	59	21	24	15	16	8	12	8	0	8	5	0	9	4	0	2	0	363
Lentils (<i>Lens esculenta</i>)	98	97	92	19	3	9	7	5	0	7	3	0	0	0	0	0	0	0	0	0	242
Vetches (<i>Vicia sativa</i>)	100	100	98	89	80	62	41	53	33	69	53	28	73	42	15	53	18	4	4	0	915
Lucerne (<i>Medicago sativa</i>)	90	88	93	76	31	25	8	14	7	9	4	0	6	8	0	4	3	0	1	0	377
White clover (<i>Trifolium repens</i>)	91	90	85	89	47	9	5	10	4	13	5	0	15	7	0	12	4	0	3	0	398

505 - **The Survival of Plant Tissues after Frost.** — RUSSEL, W. in *Comptes-Rendus de l'Académie des Sciences*, Vol. 158, No. 7, pp. 508-510. Paris, February 16, 1914.

Plant cells contract under the influence of cold, and the water passing through the cell-walls freezes in the intercellular spaces (1). The thin-walled parenchyma is dislodged by the accumulation of ice, and the portions deformed and often crushed soon show disorganisation of the protoplasm through loss of water. This disorganisation rarely affects the whole of the parenchymatous tissue; the vascular tissue, the endodermis and the pericycle generally persist, whilst the lignified and corky parenchyma often remain unchanged.

It is generally believed that plants which are not able to resist severe cold, show no living tissues after a thaw. The writer, however, using Ruzicka's reagent (2), has shown the presence of living cells amongst the disorganised tissues, and in the slightly injured tissues numerous cells took up the red stain characteristic of living protoplasm.

The damaged tissues may continue to live a considerable time after a thaw, and this is borne out by the fact that plants do not perish immediately, however wilted and disorganised their organs may appear, but may continue to live several days or even weeks (3).

Plants with living cells in the vascular tissues and adjacent parenchyma only succumb very slowly; the xylem and phloem parenchyma is the last tissue to be destroyed. Thus, a specimen of *Sonchus oleraceus* destroyed by frost at the end of December, still contained living cells on February 9th in the thick lignified cork ring at the base of the hollow stem, which had been completely decorticated.

Thus, the death of a plant through frost does not take place suddenly, but rather cell by cell, and is retarded proportionately to the amount of undamaged tissue.

506 - **The Effects of the Winter of 1913-1914 on Certain Plants.** — MOTTET, S. in *Revue Horticole*, Year 86, No. 9, pp. 202-204. Paris, May 1, 1914.

During the winter 1913-14, the soil in the neighbourhood of Paris was frozen to a depth of from 12 to 14 in. Of the newly introduced plants at the DE VILMORIN experimental ground at Verrières, those from China completely resisted the cold.

A list of the plants damaged by the frost is given below, grouped according to the extent of the damage.

(1) PRILLIEUX, Effect of frost on plants (*Bull. Soc. Bot.*, 1869) — MUELLER-THURGAU, *Landwirtsch. Jahrb.*, 1883 and 1886. — MOLISCH, Ueber das Erfrieren der Pflanzen, Jéna 1897. — MOLLIARD and MATRUCHOT, Action du gel sur les cellules (*Revue gén. de Bot.*, 1902). P. SORAUER, Wärmemangel. (*Handbuch der Pflanzenkrankheiten*. I. I. 1909).

(2) V. RUZICKA, Ueber tinktorielle Differenzen zwischen lebendem und abgestorbenem Protoplasma (*Arch. ges. Physiol.*, T. CVII, pp. 437-534).

(3) Observations on *Papaver Rhoeas*, *Sisymbrium officinale*, *Cheiranthus Cheiri*, *Trifolium pratense*, *Achillea Millefolium*, *Ballota foetida*, *Lamium album*, *Euphorbia silvatica*, *Mercurialis annua*, *Urtica urens*, etc.

A. — WOODY PLANTS.

1. Plants completely frozen.

<i>Arctostaphylos arguta.</i>	<i>Strawæsia glaucescens.</i>
<i>Duddleya macrostachya yunnanensis.</i>	<i>Pittosporum undulatum.</i>
<i>Cistus purpureus.</i>	<i>Pinus longifolia</i>
<i>Cistus hirsutus.</i>	» <i>Montezumæ</i> var. <i>Lindleyi.</i>
<i>Eugenia apiculata.</i>	» <i>cocarpa.</i>
<i>Berberidopsis corallina.</i>	» <i>microphylla.</i>
<i>Fagus Cunninghamii.</i>	» <i>Lumholzii.</i>
<i>Olearia macrodonia.</i>	» <i>pseudo-Strobus</i> var. <i>tenuifolia,</i>

2. Plants badly damaged.

<i>Arundinaria Falconeri.</i>	<i>Helianthemum roseum.</i>
<i>Arundinaria humilis</i> var. <i>gracilis</i>	<i>Teucrium fruticans.</i>
<i>Abies religiosa.</i>	<i>Pinus Montezumæ.</i>
<i>Bambusa Nagashima.</i>	» <i>patula.</i>
<i>Carpenteria californica.</i>	» <i>Teocote.</i>
<i>Lithospermum prostratum.</i>	» sp. 6956 M. V. China.
<i>Mandevillea suaveolens.</i>	

3. Plants having their leaves or only their extremities frozen.

<i>Actinidia Henryi.</i>	<i>Elaeagnis Simonii.</i>
<i>Azalea candida.</i>	<i>Keteleeria Davidiana</i>
<i>Arundinaria auriconæ.</i>	<i>Myrsine africana</i>
» <i>Simonii</i> Chinese var.	<i>Nandina domestica.</i>
<i>Azara microphylla.</i>	<i>Quercus Suber.</i>
<i>Clematis Armandi.</i>	» spec. no. 26, Yunnan.
<i>Escallonia pulverulenta.</i>	» » no. 11, Tonkin.
<i>Ercilla spicata.</i>	<i>Xylosma</i> sp. 7220 M. V. China.
<i>Garrya elliptica.</i>	New genus, no. 4395, Wilson.
<i>Eucalyptus coccifera</i> (1).	

B. — HERBACEOUS PLANTS.

1. Plants completely frozen.

<i>Anthemis moniana.</i>	<i>Erodium pelargonifolium.</i>
<i>Arundo conspicua.</i>	<i>Rehmannia angulata</i> and hybrids.
<i>Francoa ramosa candida.</i>	<i>Salvia dichroa.</i>

2. Plants more or less damaged.

<i>Aconitum Vilmorinianum.</i>	<i>Tritoma rufa.</i>
<i>Lupinus arboreus.</i>	<i>Sisyrinchium striatum.</i>
<i>Hypericum polyphyllum.</i>	

(1) Old leaves damaged. Young leaves resistant.

3. Plants of doubtful hardiness which have shown complete resistance.

<i>Asimina triloba.</i>	<i>Olearia nummulariaefolia</i>
<i>Abutilon vitifolium.</i>	<i>Pinus koraiensis</i>
<i>Abies bracteata.</i>	" <i>Ayacahuite.</i>
<i>Aristotelia Macqui.</i>	<i>Prumnopitys elegans.</i>
<i>Camellia japonica.</i>	<i>Tsuga Brunoniana.</i>
<i>Clematis cirrhosa.</i>	<i>Rhododendron campylocarpum.</i>
<i>Clematis balearica.</i>	<i>Piptanthus nepalensis.</i>
<i>Clerodendron foetidum.</i>	<i>Rosa laevigata.</i>
<i>Castanopsis chrysophylla.</i>	<i>Rhododendron Griffithianum</i> hybrids.
<i>Baccharis patagonica.</i>	<i>Eriobotrya japonica</i> (covered at the base).
<i>Fuchsia Riccartoni</i> (covered at the base).	<i>Mimosa dealbata</i> (covered at the base).
<i>Carrya Thureti.</i>	<i>Zizyphus vulgaris.</i>
<i>Oreodaphne californica</i>	<i>Punica Granatum</i> var. <i>Legrellei.</i>

507 - The Indicator Significance of Vegetation in the Tooele Valley, Utah. —

KEARNEY, T. H., BRIGGS, L. J., SHANTZ, H. L., MC LANE, J. W. and PIEMEISEL, R. L. in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 365-417, + 7 plates. Washington, D. C., February 1914.

This investigation of the correlation existing between the distribution of the vegetation and the physical and chemical properties of the soil was carried out in the Great Basin region between the Rocky Mountains and the Sierra Nevada and Cascade ranges. The problems to be solved were: 1) what types of vegetation indicate conditions of soil moisture favourable or unfavourable to dry farming, and, 2) what types indicate the presence or absence of alkali salts in quantities likely to injure cultivated crops. For the purpose of this investigation it was necessary to find a locality where both dry farming and irrigation farming are practised, where much of the land is still covered with the original native growth, and where some of the soils contain an excess of alkali salts. The Tooele Valley in Central Utah was selected as representing these conditions. The natural vegetation of this valley consists of a few easily recognisable and sharply delimited plant communities, the distribution of which is largely determined by the moisture relations and the salt-content of the soil.

These correlations are summarised in the table opposite.

The sage brush (*Artemisia tridentata*) occurs nearest the mountains where the soil is of a light, permeable texture, rather low in moisture holding capacity, and free from an excess of alkali salts, and where the moisture available for growth is usually exhausted early in summer. A good growth of sage brush indicates suitability for both dry and irrigation farming, but where the growth is thin and poor irrigation is necessary.

The Kochia (*Kochia vestita*) association occurs just below the sage brush belt. The soil is of a finer texture, less permeable and with a higher moisture holding capacity, and the subsoil has a higher salt content. Dry farming is precarious owing to the shallow depth of soil free from alkali and its impervious nature hinders the washing out of the salts by irrigation.

Type of vegetation	Moisture and salinity conditions.					Is land capable of crop production ?	
	Source of moisture	Moisture content above or below wilting coefficient (1) average of 4 feet	Salt content average to depth of 4 feet	Surface soil	Soil below one foot	Without irrigation	With irrigation
Sagebrush (<i>Arimisia tridentata</i>)	Direct precipitation	— 0.8	0.4	Non-saline, usually dry in summer	Non-saline, usually dry in late summer	Yes	Yes
Sandhill mixed (<i>Arimisia tridentata</i> , <i>Juniperus monosperma</i> , etc.)	do			do	Non-saline, usually moist in summer		
Shadscale (<i>Atriplex confertifolia</i>)	do	— 5.3	0.52	do	Saline, usually dry in late summer	Precariously, conditions rather more favorable than on Kochia land	Yes; after alkali is removed
Kochia (<i>Kochia vestita</i>)	do	— 3.0	0.70	do	Saline usually dry, in late summer	Precariously in years of rainfall above the normal	Yes, if alkali can be removed
Greasewood-shadscale (<i>Sarcobatus</i> and <i>Atriplex</i>)	Direct precipitation and high water table	+ 3.0	0.81	Saline or non-saline, usually dry in summer	Saline, moist	No	Yes, after alkali is removed
Grass flat (Salt grass, <i>Distichlis spicata</i>)	Direct precipitation, high water table, springs and irrigation	+ 12.1	0.86	Moderately saline, moist	Moderately saline, moist	Probably not	Possibly, with drainage
Salt flat (<i>Allenrolfea occidentalis</i>)	Direct precipitation and high water table	+ 4.2	1.11	Saline, moist	Saline, moist	No	No

(1) Wilting coefficient = the quantity of water as percentage of dry weight remaining in the volume of soil occupied by the active roots of a plant which is beginning to wilt. — All data are given as percentages of the dry weight of the soil.

The shadscale (*Atriplex confertifolia*) association occurs below the Kochia belt. The soil is similar, but frequently contains much gravel and is drier during the summer months. Owing to its greater permeability, irrigation farming would be possible on this land.

The greasewood-shadscale (*Sarcobatus vermiculatus* and *Atriplex confertifolia*) association occurs between the pure shadscale vegetation and the salt flats and also on the ridges and knolls intersecting the latter. The soil generally contains sufficient available moisture below the first foot during the summer and considerable quantities of alkaline salts. Land of this type is not suitable for dry farming, but can be made to produce good crops under irrigation, especially when drainage is provided.

The presence of the grass-flat (*Sporobolus*, *Distichlis*, *Chrysothamnus*) vegetation indicates a soil with high moisture capacity, moist to the surface during a great part of the year and more or less saline. Such land produces a coarse natural pasturage, but is not suitable for crop-production until drained.

The salt-flat (*Allenrolfea*, *Salicornia*) vegetation occupies land which is extremely saline and wet to the surface during a great part of the year. This type of land is not adapted to crop production.

508 - **The Error in Water Culture Experiments due to the Presence of Traces of Zinc in Glass.** - JAVILLIER, M. in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 158, No. 2, pp. 140-143. Paris, January 12, 1914.

Culture experiments with *Aspergillus niger* in Raulin's solution with and without zinc show different results according to the nature of the vessel employed. Thus:

	Dry weight in grammes.		
	Bohemian Glass (Kavallier)	Jena Glass (Schott and Gen)	Quartz glass
Raulin solution without zinc	0.352	1.861	0.291
" " with zinc	1.780	1.736	1.624

In a solution of hydrochloric acid equivalent in acidity to that of Raulin's solution the writer found 0.05 mgm. of zinc per 125 cc.

509 - **Contribution to the Study of the Formation of Hydrocyanic Acid in Plants.** - JORISSEN, A. in *Bulletin de la Classe des Sciences de l'Académie Royale de Belgique*, No. 3, pp. 130-137. Brussels, 1914.

As the result of a number of laboratory experiments, the writer concludes that hydrocyanic acid may be produced in dilute solutions of potassium nitrite and citric acid when the latter is subjected to oxidation by the action of small quantities of iron salts under the influence of light rays. One stage in the transformation would be acetone-dicarboxylic acid ($\text{COOH-CH}_2\text{-CO-CH}_2\text{-COOH}$) which is produced by the action of heat on a mixture of concentrated sulphuric acid and citric acid, or by the action of potassium permanganate on citric acid. Acetone-dicarboxylic acid yields hydrocyanic acid in the presence of dilute solutions of potassium nitrite.

510. - **Note on the Displacement Curves (1) of Organic Bases and their Application to the Determination of the Strength of Alkaloids.** — GOUBAU, R. in *Bulletin de la Classe des Sciences de l'Académie Royale de Belgique*, No. 1, pp. 63-90. Brussels, 1914.

The writer has applied the method of DUTOIT to the determination of certain alkaloids. A known quantity of hydrochloric acid is added to a given quantity of the alkaloid. The solution of the salt thus obtained is diluted with water or alcohol. The conductivity is then determined at constant temperature. A solution of normal or decinormal caustic soda is added, 0.1 cc. at a time, and the displacement of the alkaloid by each addition of caustic soda is determined by the change in conductivity of the solution. A displacement curve is obtained by plotting the conductivity against the quantity of caustic soda.

The first part of the curve is a straight line corresponding to the neutralisation of the free acid; the second part, corresponding to the hydrolysis of the alkaloid, consists of one or more straight lines according as the alkaloid is mono or polybasic; the third part corresponds to the addition of excess of the soda solution. The angles of the curve are more acute in proportion as the solution is less hydrolysed.

The method has been successfully applied to the following alkaloids: *Cocaine* in solution in alcohol, even in the presence of small quantities of sugar, colouring matter, etc. *Homatropine* in a solution of equal quantities of water and alcohol, and hydrolysed by normal caustic soda solution. *Atropine* in a solution of equal quantities of water and alcohol. The percentage of atropine in pharmaceutical preparations of belladonna can be determined with accuracy by extracting the acid solution with ether or chloroform after removing foreign matter such as resin, chlorophyll, etc. The percentage of *aconitine* in laboratory preparations of aconite can be determined in the same way. *Pilocarpine* and *codeine* are determined in aqueous solutions; *strychnine* in a solution of 5 parts of alcohol to 4 parts of water. These proportions are less reliable for *coniine* (hemlock) and *nicotine* owing to hydrolysis of the salts. The curve for *morphine* (which may act either as a base or an acid) consists of four sections corresponding to the neutralisation of free acid, the displacement of morphine, the formation of sodium morphinate and the addition of free alkali. •

- 511 - **Methods and Results of the Selection of Flax in Russia.** — ALTHANSEN, J. (Laboratory of Agricultural Chemistry, Central Administration of Agricultural Organisation at St. Petersburg) in *Russisches Journal für experimentelle Landwirtschaft*, Vol. XV, Part 1, pp. 12-47 + 11 plates (German Summary, pp. 48-53). St. Petersburg, 1914.

PLANT
BREEDING AND
AGRICULTURAL
SEEDS

An account is given of the principles and methods applied to the selection of flax at the Laboratory of Agricultural Chemistry, St. Petersburg. The native varieties of flax consist of mixtures of types affording excellent

(1) See B. Dec 1912, pp. 2562-2569, original article on « Analysis of wines by a Physico-chemical Volumetric Method » by P. DUBOUX and M. DUTOIT. (E. d.).

material for the selection and separation of strains. Although pure line varieties chosen for some special peculiarity offer distinct advantages, the power of resistance to unfavourable conditions of growth is greater in a variety consisting of a mixture of types. Thus it is possible that certain mixtures of pure lines will give the best results. The isolation of types is comparatively easy, even for the less evident characters, and hybridisation experiments are also being carried out.

In 1913, 601 F_1 generations and 195 F_2 generations had been obtained. The combination and the separation of types is not difficult to observe and does not require much time. Selection is conducted in the laboratory on the results of field observations and determinations of the quality of the fibre.

Great importance is attached to field trials on a large scale. The numerous measurements and the counting necessary are effected with as much economy as possible. Young people who need only read, write and count are employed for the mechanical work, each determination being made by two persons independently. In reducing the necessary measurements to express the character of the type, much calculation and time is saved by using the "individual" mean in place of the arithmetic mean. This method works as follows: the selected plants are arranged in the order of their heights; the centre plant of the series and five neighbours on each side of it are then measured. The arithmetic mean of these plants is considered as the "individual" mean of the series and is sufficiently accurate for practical purposes. The economy of time thus effected enables determinations to be made of other characters, such as length of unbranched stem, diameter of stem and the number of seeds.

The selected types are grown in rows between rows of native varieties, so that the result of each row can be compared with the results of two rows of a control variety. The accuracy of the trials is increased in the second generation by sowing four rows of each strain from the seed produced in the first generation. The risk of cross-fertilisation in this method is inconsiderable, since self-fertilisation is the rule in flax.

The sowing of the seeds is facilitated by arranging them in the laboratory on strips of perforated cardboard. The strips are the length of the rows and the lower side of the perforations is closed by a sheet of thin paper. The seeds therefore rest in small cavities thus formed, about $\frac{1}{2}$ in. apart, and, at planting time, the strips are laid on the soil and the seeds buried by means of a glass rod. This method ensures accuracy and economises time and labour. It is also used for testing the strains on a larger scale, by using larger sheets of cardboard and dispensing with the alternate rows of native varieties. In this case each sheet holds 120 seeds and two such sheets containing different varieties constitute a trial plot. The plots are duplicated from 4 to 8 times.

When sufficient seed has been obtained, the strains are then grown as field cultures and determinations made of the quality of their fibre. This stage has now been reached by varieties which have been under selection since 1909.

- 512 - On the Appearance of Sterile "Dwarfs" in *Humulus Lupulus* L. — SALMON, E. S. in *Journal of Genetics*, Vol. 3, No. 3, pp. 195-200 + 3 plates. Cambridge, February 1914.

In experiments on hybridising various male and female hops, numerous sterile dwarfs appeared in the F_1 generations. These dwarfs are characterised by very feeble growth the first year, by the subsequent development of numerous shoots prostrate on the surface of the ground or forming an erect bush-like growth about one foot high, and by the complete absence of flowers even after 7 years' growth. The proportion of sterile dwarfs to normal plants in the F_1 generations varies in different crosses and is greatest in those in which the male hop is a form from Oregon, U. S. A.

- 513 - A Preliminary Note on the Genetics of *Fragaria*. — RICHARDSON, C. W. in *The Journal of Genetics*, Vol. 3, No. 3, pp. 171-177 + 4 figs + 1 plate. Cambridge, February 1914.

Crosses between *Fragaria vesca semperflorens*, a runner-producing plant, and *F. de Gaillon*, a runnerless species, always produce runner-producing plants in F_1 and runner and runnerless plants in F_2 , the runner being a marked dominant.

A cross between *F. vesca* having normal trifoliate leaves and *F. monophylla* produced normal plants in F_1 , and showed segregation in F_2 , producing 177 normal plants and 73 with single leaves.

Eight garden varieties were selfed and some 1000 plants obtained. Of these none showed any resemblance to *F. vesca* or to any Alpine species, but many showed distinct traces of *F. chinensis*, more of *F. virginiana* and not a few of *F. chinensis*. The leaf-character of "Hantbois" occasionally appears in those of French origin.

"St. Antoine de Padoue", a perpetual variety, was selfed and produced an F_1 generation consisting of 93 perpetuals, 35 non-perpetuals and 2 doubtful ones. Examination of these same plants the following year showed them to consist of 108 perpetuals and 22 non-perpetuals. "Laxton's Perpetual" gave an F_1 generation of 69 perpetuals, 11 non-perpetuals and 2 doubtful.

A cross between "Bedford Champion" (non-perpetual) and Laxton's Perpetual gave rise to 24 perpetuals and 53 non-perpetuals, whereas the simplest expectation would have been equality.

One of these F_1 non-perpetuals gave rise to an F_2 generation consisting of 8 non-perpetuals and 6 perpetuals, and an F_1 perpetual produced 14 non-perpetuals and 5 perpetuals in F_2 .

The evidence points to the existence of several factors determining the perpetual character.

Experiments on the inheritance of sex were made with female *F. virginiana* and male *F. chiloensis lucida*.

$$\begin{array}{l}
 \text{Thus, } \begin{array}{ccc} F. \text{ virginiana} & \times & F. \text{ chilcensis} \\ 16 \text{ } \text{♀} & & 12 \text{ } \text{♂} \end{array} \\
 \text{and } \begin{array}{ccc} F. \text{ virginiana} & \times & F. \text{ chilcensis lucida} \\ 49 \text{ } \text{♀} & & 27 \text{ } \text{♂} \end{array} \\
 \text{and } \begin{array}{ccc} F. \text{ virginiana} & \times & F. \text{ grandiflora} \\ 20 \text{ } \text{♀} & & 0 \text{ } \text{♂} \end{array}
 \end{array}$$

A cross between *chiloensis* hermaphrodite and *grandiflora* hermaphrodite produced a minority of hermaphrodites, a majority of males and no females, while the cross *virginiana* female and *grandiflora*, mentioned above, produced no males.

It appears that most characters of *Fragaria* are capable of segregation, but the occurrence of a certain amount of "linking" may present difficulties requiring many years to solve.

514 - **The Farmers' Seed-Growers' Cooperative Association in Wisconsin.** — MATENÄERS, F. F. in *Deutsche Landwirtschaftliche Presse*, Year XXXI, No. 29, pp. 363-364. Berlin, April 11, 1914.

The seed-growers' association known under the name of the "Wisconsin Experiment Association" was founded on a cooperative basis in the year 1901 by 187 members. In order to make sure that the members recognised the full importance of the objects in view, it was decided that at first only the farmers who had attended a State school of agriculture would be admitted as members.

The expenses of the Association were defrayed by the members only during the first two years. Since 1903 the State has granted a subsidy, which last year amounted to about \$ 5000.

The activity of the Association has been considerable from the very beginning. After the secretary of the Association had decided upon the most suitable varieties of seed at the farm of the Experiment Association, every member received enough seed for two acres with which to carry out comparative trials. Altogether the experiments are conducted on a large scale; thus for five years 1020 members experimented with barley and 1500 with maize. Already, from the beginning, the members in the various counties were invited to form centres for the supply of selected seeds in their vicinity. In this way 1500 centres for maize were established by the side of those for barley, oats and rye, and their action was such that the neighbouring farms soon adopted the new varieties and thus the desired uniformity in the varieties cultivated was attained, which contributed largely to the present reputation of the Association for its maize and other cereals.

The Association has also rendered valuable service in the control of plant diseases.

(1) The signs refer to the sex character of the species as well as to the sex of the parent. (Ed.).

Owing to the considerable growth of the Association, a certain decentralization has become necessary. It has been met by the foundation of local sections for the several counties, which bear the title of "County Orders of the Experiment Association." They are under the supervision of the central management and have a secretary who is appointed and paid by the State Association. When in a county more than fifty farmers grow seeds according to the instructions of the Association, such County Orders are founded. At present there are thirty-eight of them.

For the sale of the selected seed, special packages bearing the trademark of the Association are used. But previously, in the course of the year, the secretary of the County Order must have inspected the methods of selection and other treatment of the seed, and the central Association must have made a final examination of the seed. A special list is kept of the names of the producers of "inspected" seeds.

For the further promotion of the sale of seeds, the State Association has already erected some seed granaries furnished with the necessary appliances.

515 - Report on the Work of the State Seed-testing Station in Denmark in the Year 1912-13. — *Communication by the Director, K. DORPH-PETERSEN.*

This seed control station is the oldest in the world; it was founded in 1871 by E. MÖLLER-HOLST and taken over by the State in 1891. The importance which it has gained may be seen from the number of samples examined yearly and which, from 373, the average for the first five years of its existence, has risen to 14213 in the year now reported upon. Plant breeders and other farmers and their associations sent 6756 samples for examination in 1912-13.

The seeds are examined as to their quality and place of origin. For the latter the so-called characteristic seeds are looked for. Examinations as to origin are especially frequent for clover seeds and have largely contributed to prevent the importation of undesirable seeds. In the year of the Report, 176 determinations of the place of origin were made.

In the investigation into the purity of the goods, two average samples of at least 1000 seeds each are taken and the following determinations are made: a) content in seeds of the kind which gives its name to the parcel; b) the offal (earth, stones, broken seeds, etc); c) seeds of other cultivated plants; d) seeds of weeds. For the various contents the percentage by weight is given in the examination certificate. In the case of specially noxious weeds their number per kilogram is given also. The diaphanoscope is used for grass seeds that are difficult to examine. If the difference in the proportion of pure seeds in the two average samples is more than 2 per cent., a third determination as to purity is made and an average drawn from the three. A parcel which contains upwards of 15 per cent. of seeds of other cultivated plants is declared to be mixed goods. When the content of weeds and offal is considerably above the usual quantity, the sample is designated as "impure seeds". In 1912-13, 8957 determinations as to purity were made.

For the determination of germination capacity, six lots of one hundred "pure seeds" are placed to germinate in special apparatus. For most small seeds, Jacobsen's or the Copenhagen apparatus is used, as it ensures uniform moisture and allows the temperature to be regulated with precision.

For cereals, pulse and beets the germination capacity is determined after 10 to 12 days, for grasses after 15 to 20. The germination energy is determined after about one-third of the above time.

In 1912-13, 11431 germination tests were carried out, and in 6624 of these the purity and weight of the seeds were also determined. Further, 255 examinations for moisture content were made.

Of the samples examined, 1701 were so-called "second analyses" of seeds which had been delivered to farmers, associations or small traders. Thirteen seedsmen have made an agreement with the Station according to which they must send the latter the addresses of all their clients to whom they have sold guaranteed seeds, and this immediately after delivery. The Station then sends the purchasers instructions for taking samples and a small bag for the same. The examination is charged to the vendor. The results of the examinations are communicated to all the purchasers of the 13 seedsmen and they are also published in the yearly report of the Seed-testing Station. Most of the consignments made during the year have come up to the guarantee. Some of the seedsmen, however, have had to pay some compensation under the agreement with the Station.

The examination of seeds sold by traders who had no connexion with the Station showed that nearly one half of the samples did not correspond to the guarantee given with them. Out of the 17 ½ million lbs. of seeds sold in Denmark for grass leys, nearly 12 million lbs. are delivered by the controlled firms. A great proportion of root crop seeds were also tested by the Station.

The present state of seed testing has been brought about without any special legislation or other public measure.

The cost of testing is from 1s 1¼d to 7s 8½d per sample. Last year the State granted the Station £200. The rest of its expenses, the whole of which amount to £1925, is covered by the fees.

516 - Impurities in Seeds in Victoria, Australia. — Communicated by the Department of Agriculture.

Report on seed examined in January and February 1914.

Variety of seed	Country of origin	Weed seeds	
		Species	Percentage
1. Red clover (<i>Trifolium pratense perenne</i>) .	Germany	<i>Cuscuta</i> sp.	0.39
		<i>Prunella vulgaris</i>	0.05
		<i>Daucus Carota</i>	0.12
		<i>Rumex crispus</i>	1.17
2. White clover (<i>Trifolium repens</i>)	Russia	<i>Rumex Acetosella</i>	5.07
		<i>Spergula arvensis</i>	0.21
		<i>Cuscuta</i> sp.	0.09
		<i>Rumex crispus</i>	0.79
3. Cowgrass (<i>Trifolium pratense perenne</i>) . .	Austria	<i>Carduus lanceolatus</i>	0.02
		<i>Daucus Carota</i>	0.02
		<i>Polygonum Convolvulus</i>	0.02
		<i>Rumex Acetosella</i>	3.61
4. Alsike (<i>Trifolium hybridum</i>)	Russia	<i>Cuscuta</i> sp.	0.11
		<i>Daucus Carota</i>	0.02
		<i>Rumex crispus</i>	0.18
		<i>Cuscuta</i> sp.	0.02
5. Red clover (<i>Trifolium pratense perenne</i>) . .	Germany	<i>Raphanus</i> sp.	0.22
		<i>Cuscuta</i> sp.	0.12
		<i>Cuscuta</i> sp.	0.14
		<i>Rumex crispus</i>	0.32
6. Lucerne (<i>Medicago sativa</i>)	Germany	<i>Conium maculatum</i>	0.02
		<i>Galium Aparine</i>	1.003
		<i>Polygonum Persicaria</i>	0.09
		<i>Polygonum Convolvulus</i>	0.45
7. Cowgrass (<i>Trifolium pratense perenne</i>) . .	Germany	<i>Conium maculatum</i>	0.07
		<i>Erysimum repandum</i>	1.49
		—	—
		<i>Cuscuta</i> sp.	0.25
8. Cowgrass (<i>Trifolium pratense perenne</i>) . .	Germany	<i>Chenopodium album</i>	1.15
9. White Mustard (<i>Sinapis alba</i>)	Germany		
10. Gold of pleasure (<i>Camelina sativa</i>)	Germany		
11. Cress (<i>Lepidium ruderale</i>)	Germany		

In Nos. 2 and 4, $\frac{1}{4}$ oz. of seed was examined, in all the others 3 oz. Nos. 2 and 7 were cleaned under supervision.

Nos. 9 and 11 contained a small percentage of grit and lodging (stalks, etc.).

Nos. 1, 3 and 8 contained also a little *Plantago lanceolata*; No. 4 *Plantago lanceolata*, *Medicago lupulina* and *Phleum pratense*; No. 5 *Plantago lanceolata* and *Cichorium intybus*; No. 6 *Pennisetum* sp.

CEREAL AND
PULSE CROPS

- 517 - **Investigations on Barley in Connection with the Separation of the Glumes through Rapid Drying.** — STIMMELMAYER, A. in *Landwirtschaftliche Zeitung*, Year 63, Part 6, pp. 214-216. Stuttgart, March 15, 1914.

The writer carried out at the Seed Selection Station at Weißenstephan, Bavaria, a series of experiments on a barley which showed no tendency to separate from its glumes, with the object of studying the influence of alternative moistening and rapid drying on the separation of the grain from the glumes.

Four groups of three ears with sound grains were steeped in separate vessels containing spring water at a temperature of 20° C. In the first experiment each lot of ears was steeped and dried for a different length of time at about 45° C., the ears being weighed after each operation in order to determine the average amount of water absorbed.

The result of the first experiment was generally negative; only on a few grains could some cracking of the glumes be observed. The experiment was repeated three times with the same ears. At the third steeping the average weight of the ear after 24 hours' immersion had risen from its normal initial weight of 1.85 grams to 2.62 grams, that is it had absorbed 41.6 per cent. of water; after eight hours' desiccation the average weight of the ear was 1.87 grams. The glumes of 28.2 per cent. of the grains were damaged by the repeated steeping and desiccation, which shows clearly that the alternative wetting and drying undergone by corn during the summer causes the glumes to crack without the intervention of any mechanical action. Repeating the steeping and desiccation a fourth time did not alter the condition of the grain.

To determine the effect of mechanical action, the above ears and others which had not been treated were vigorously rubbed by hand, and the damaged glumes and naked grains were counted. The untreated ears contained 28.4 per cent. of damaged grains, and of these 0.3 per cent. were quite naked; the treated ears contained 62.4 per cent. of damaged grains, of which 3.7 per cent. were quite naked. This simple experiment shows clearly that the connection between the grain and the glume is loosened by alternate steeping and drying and becomes apparent when the grain is subjected to rough treatment, as is the case, for instance, in threshing. The loss of glumes in threshing, however, is far less serious to malting barley than the injury that may be caused by threshing in dry years when the grain is brittle and the damage is generally deeper and decreases the germinating power.

FORAGE CROPS.
MEADOWS
AND PASTURES

- 518 - **Analysis of Teosinte Seeds (*Reana luxurians* = *Euchlaena luxurians*, Asch.)** (1). — *Revue des Colonies*, Year 8, No. 3, pp. 139-141. Brussels, March 1914.

Chemical analysis of the kernels of this plant shows that it contains more food material than any cereal. The low food value of the seeds as a whole is due to the large percentage (56.37) of pericarp:

(1) See also No. 43, B. Jan. 1911 and No. 1567, B. Aug.-Sept.-Oct. 1911. (Ed.).

	Per cent of fresh kernel	Per cent of dry matter
Humidity (100° C.)	13.46	—
Mineral matter.	1.36	1.57
Fat	4.16	4.80
Cellulose (Weende)	1.43	1.65
Total nitrogenous matter.	21.25	24.57
Nitrogen-free extract (starch).	53.10	61.38
Pentosans	1.01	1.16
Undetermined	4.23	4.87
Total	100.00	100.00

The high proportions of nitrogenous matter, fat and starch give this kernel a food value of the highest order, as shown by the following figures :

	Food units in 100 parts of dry matter
Teosinte, seeds	135
Wheat flour	156
Flour from teosinte kernels	208.5
Lentil flour.	230

519 — **The Cultivation of Sulla (*Hedysarum coronarium* L.) in Rice Fields.** — SBROZZI, D. in *Il Cultivatore*, Year 60, No. 9, pp. 262-268. Casale Monferrato, March 30, 1914.

French honeysuckle or Sulla has long been known as a valuable forage crop for dry land cultivation in hot countries, but it is only within recent years that its suitability for cultivation in rice fields has been shown by experiments in Italy. The advantages of this forage crop are that it requires little cultivation, no special manuring and that it improves the soil by its deep rooting habit ; it leaves a considerable amount of humus behind and yields more forage than any other crop under similar conditions.

Seed is sown at the rate of about 2.68 lbs. per acre before harvesting the rice, about August 20th. After about a week, germination takes place and the rice is harvested. Small ditches are then cut to facilitate the drainage of the fields and the crop receives no further attention until the following spring, when it is thoroughly weeded. The crop is ready for cutting at the end of July. The residual phosphates of the manuring for the preceding rice crop are sufficient for the needs of this plant, and its deep rooting habit gives the soil an excellent preparation for the following wheat crop. This crop is therefore most suitable for making the transition from wet to dry land cultivation. The average yields obtained are 2½ cwt. per acre, valued at £3 12s per cwt.

The cost of cultivation and returns per acre are as follows:

<i>Expenses:</i>	£	s	d	£	s	d
Seed		2	6			
Sowing and opening ditches		8	0			
Weeding		3	3			
Cutting		14	3			
Transport		12	9			
Threshing		1	8	9		
Total				3	9	6
<i>Returns:</i>						
Seed		8	12	9		
Straw			19	3		
Total				9	12	0
Net profit per acre	£	6	2	6		

520 - Cultivation Experiments with *Vicia striata* in Hungary, 1908-11. — GYÁRFÁS, J. in *Kísérletügyi Közlemények*, Vol. XVII, Part 1, pp. 1-11, Budapest, January-February 1914.

Vicia striata, a plant indigenous to Hungary, has long been recommended as a forage crop for alkaline soils, and the Royal Hungarian Experimental Station at Magyaróvár has carried out a long series of experiments with both pot cultures and field trials in cooperation with several agriculturists.

The conclusions arrived at are as follows:

1) *Vicia striata* is less resistant to the action of saline salts than *V. sativa* and is consequently unsuitable for alkaline soils.

2) As a spring crop on good land it has little agricultural value, its growth being inferior to that of *V. sativa*.

3) It gives better results as an autumn crop and would probably be useful as a winter forage crop, being as resistant to cold as *V. villosa*.

4) Sown in the autumn and harvested as an early crop before the flowering period, i. e. about the end of May or beginning of June, it yields a crop as large as that of *V. villosa*.

The experiments are being continued on a large scale.

521 - On the Coagulation of the Latex of *Manihot Glaziovii*. — MARK, T. in *Der Pflanzer*, Year X, No. 3, pp. 149-157. Darussalam, March 1914.

The writer shows that magnesium sulphate either alone or mixed with other substances is of no practical value. He criticises the use of certain coagulants such as the juices of the citrus and papaw, which introduce impurities difficult to remove by washing and which lower the quality of the rubber.

The experiments carried out at Amani on the use of calcium chloride in combination with other substances are summarised in the following table. The coagulants described as "good" may be used throughout German East Africa except in the coastal regions; those described as "very good" should be used in a solution diluted according to the local climatic conditions, the composition of the water, and the concentration of the latex.

No.	Composition of coagulant %	Coagulation	State of coagulum	Value	Remarks
1	calcium chloride . . . 0.5 carbolic acid 0.5	poor	thick filaments with large nodules	none	
2	calcium chloride . . . 0.5 acetic acid 0.5	good	thick narrow strips	useful	
3	calcium chloride . . . 0.5 carbolic acid 0.3 acetic acid 0.15	poor	like No. 2.	useful in some cases	For use only on dry plantations
4	calcium chloride . . . 0.75 acetic acid 0.75	very good	thick and narrow strands	useful	
5	calcium chloride . . . 1.0 carbolic acid 0.25	poor	narrow threads	useful in some cases	
6	calcium chloride . . . 1.0 carbolic acid 0.3 acetic acid 0.15	good	like No. 2.	useful	
7	calcium chloride . . . 1.0 carbolic acid 0.5	good	like No. 4.	useful	Too weak for young trees and wet districts
8	calcium chloride . . . 1.0 acetic acid 1.0	very good	like No. 4.	useful	
9	calcium chloride . . . 1.0 acetic acid 0.25	good	thick narrow strips well coagulated	useful	
10	calcium chloride . . . 1.25 acetic acid 0.5	good	like No. 9.	useful	
11	calcium chloride . . . 1.25 carbolic acid 0.5	good	like No. 9.	useful	
12	calcium chloride . . . 1.25 carbolic acid 0.75	very good	like No. 9.	useful	
13	calcium chloride . . . 1.5 carbolic acid 0.25	very good	like No. 9.	useful	
14	calcium chloride . . . 1.5 acetic acid 0.5	good	like No. 4.	useful	
15	calcium chloride . . . 1.5 carbolic acid 0.5	very good	like No. 9.	useful	
16	calcium chloride . . . 1.5 acetic acid 1.0	very good	thick narrow strips easily separable	useful	Too strong for hot dry districts
17	calcium chloride . . . 1.5 acetic acid 0.25 carbolic acid 0.25	very good	like No. 16.	useful	

- 522 - **The Coagulation of the Latex of *Hevea brasiliensis*, and its bearing on the Strength of Rubber.** — BARRITT, N. W. in *The Journal of the Society of Chemical Industry*, Vol. XXXIII, No. 6, pp. 289-293 + 4 figs. London, March 31, 1914.

Experiments on the behaviour of latex in solutions of varying concentration of acids and salts show that the coagulation of latex is analogous to the coagulation of protein solutions. Thus the coagulating effect of salts varies according to the basic radicle in the order of Hofmeister's series. Mineral acids up to a certain concentration increase the quantity of salt required to effect coagulation, but at higher concentrations less salt is required. With organic acids no limiting concentration was found above which coagulation took place without increase in concentration of salt.

Since the physical properties of proteins depend upon the concentrations of salt and acid with which they are in equilibrium, it seems very probable that the physical properties of plantation rubber are dependent on the concentration of the salts and acids in the latex at the time of coagulation. Thus, the addition of water and dilute acid would appear to be the cause of the variability and inferiority of plantation rubber compared with Fine Hard Para prepared by the Amazonian smoking method. The adoption of uniform methods of coagulation by acid on estates would not remove the variability of the product, owing to the natural variation in the composition of latex due to genetic and physiological differences in the trees and the influence of climatic variations.

The standardisation of plantation rubber, therefore, becomes exceedingly difficult and involves testing the product of each individual coagulating vessel.

VARIOUS CROPS

- 523 - **Precautions for the Growing and Transplanting of Liberian Coffee.** — FAUCHÈRE, A. in *L'Agriculture pratique des pays chauds*, Year 14, No. 131, pp. 81-83, Paris, February 1914.

The slow growth and late maturity of the Liberian coffee is attributed to the lack of care in the preparation of the nurseries and the transplanting of the young plants. By observing the following precautions the trees may come into bearing 18 months earlier.

Nurseries. — In order to be able to lift the plant with a ball of soil, the seeds should be sown in a clay soil at least 10 in. apart each way. There should be a nursery for each 25 acres of land, so as to avoid excessive transport, and each nursery should contain twice the number of plants required so as to allow for a careful selection.

Transplanting. — A plant 14 inches high should be lifted with a ball of soil 8 inches deep and 5 inches in diameter. Neglect of these conditions delays maturity from 1 to 2 years and endangers the life of the plants.

- 524 - **"Autumnal Flavour" of Tea.** — *The Indian Agriculturist*, Vol. 39, No. 3, pp. 71-72. Calcutta, March 2, 1914.

At the beginning of the cold season in the north of India the leaves of the tea plant undergo a change which gives the tea a very special aroma known as "autumnal flavour" and the leaves require a different treatment

from that during the rest of the year. The following method is the outcome of many years' experience.

The leaves are brought to the factory three times a day, at 12.30, 2, and 4.30 p. m., and are kept in a fresh state until 10 p. m. They are then rolled for half an hour, sifted and rolled again. Fermentation is allowed to take place during the night, and in the early morning the leaves are rolled again and dried. The whole process occupies only 10 hours. The increased expenses of the night labour are compensated for by the higher value of the product thus obtained.

525 - Recognition of Tanning and Colouring Matters by Means of the "Mulhouse Band". — BERTEAU, A. in *L'Agronomie coloniale*, Year I, No. 9, pp. 65-79. Paris, March 1914.

A simple process for the detection of tanning materials and dies has been investigated by the "Jardin Colonial" of Nogent-sur-Marne. It consists in the use of the "Mulhouse band"; this is a piece of cloth 8 inches wide, divided into five zones treated with different mordants, with a small untreated piece between every two zones. The mordants are: 1) strong iron salts, 2) weak iron salts, 3) half iron, half alumina, 4) weak alumina salts, and 5) strong alumina salts.

Tannins, precipitating iron salts, show up specially on the first zones, which become tinted with some colour between black and brown or green; the true colouring matters show on the alumina zones.

The Mulhouse band is put into boiling water containing some of the substance to be examined; another band is treated in the same way, but using some standard tanning or colouring material. If, on comparing these two bands, it is found that the substance seems to contain valuable materials, it should be sent to some laboratory for proper analysis.

526 - Problems Concerning the Utilisation of the Dum Palm in Italian Erythrea. — BALDRATI, I. in *L'Agricoltura Coloniale*, Year 8, Nos. 2 and 3, pp. 85-107 and 182-200, + 4 figs. Florence, February and March 1914.

The exportation of the fruits of the dum palm (*Hyphaene*) from Italian Erythrea only attained any importance towards 1906, since when progress has been rapid, as is seen from the following figures:

Year	1907	1908	1909	1910	1911	1912	1913 (10 months)
Exports in tons	532	1693	485	3204	3832	3726	3655

Two types of fruit are distinguishable: 1) Oval in shape, with smooth surface; 2) elongated and irregular in shape, with protuberances. The second type has larger fruits and nuts with flat faces and is superior in industrial value. Each type includes two varieties: one with sweet fruits of a deeper red colour and heavier, the other with bitter fruits almost without pulp but more suitable for producing vegetable ivory.

The dum palm groves in Erythrea are only of recent formation and are extending rapidly. The spread of this palm is effected by means of elephants; the entire fruits are consumed and the kernels germinate after

passing through the animals. The spread has also been promoted by the periodical emigrations of the Beni Amer tribes.

It has been feared that the exportation of the fruits would interfere with the natural reproduction of this palm, but the writer points out that such fears are groundless considering the importance of propagation by means of suckers; groups of palms of the same sex and derived from one plant are frequently found in the forests, and propagation by means of suckers is preferred in the formation of new plantations.

Since one male tree is sufficient to pollinate ten female trees, it is important to be able to identify the sex of a tree before flowering. According to GRANT and BECCARI the males are recognised by the foliage covering the trunk, whilst the females have bare trunks. The writer finds this not to be the case, and distinguishes the sexes according to the size of the leaves and number of segments as follows:

	Male inches	Female inches
Leaf blade	47-51	58-70
Petiole	39-47	47-62
No. of segments . . .	71-79	80-86
	(always odd)	(always even)

At a distance, the leaves of the female trees may be recognised by their numerous leaflets and the incurving of the lower part.

Regular and abundant rainfall produces an abundance of flowers and a good yield appears to be dependent on the wind. As a rule good and bad harvests alternate:

1907 harvest very poor	1911	harvest poor
1908 " very good	1912	" good
1909 " good	1913	" medium.
1910 " very good.		

The exact age at which this palm begins to fruit is not known, but the writer considers it is two or three years later than in the case of the date palm. Although often cited as a xerophyllous plant, this palm is only found in luxuriant growth in deep alluvial soils periodically inundated. The plantations require protection against the ravages of fire, monkeys, parrots and the natives.

The yield varies from 4600 to 7600 lbs. per acre of 40 to 50 female trees. If the number of male trees were reduced to one for every ten females, the number of female trees would be increased to from 70 to 100 per acre and the yield increased to an average of 13000 lbs., corresponding to 4600 lbs. of kernels.

The cost of the nuts at Genoa amounts to £7 to £9 per ton.

The writer concludes by an account of the different uses of the dumb palm and the improvements to be made in its utilization.

527 - **Field Cultivation of Capsicum in Meglena, Hellenic Macedonia.** — *Communication from PANAYOTIS A. DÉCAZOS, Chief of the Department of Agriculture of Macedonia (Salonica).*

Capsicum powder, or "red pepper", is used throughout the Balkan countries (Turkey, Roumania, Bulgaria, Servia) and in Hungary, especially by the agricultural population, as a condiment in the preparation of food. The most esteemed products of capsicum are those with the "hottest" flavour; these are produced almost exclusively in Meglena (Turkish, Karadjova), Hellenic Macedonia, in which valley this cultivation predominates and is so extensive as to be considered an agricultural rather than a horticultural industry.

The fertile soils of this valley are derived chiefly from argillaceous schists and limestones and are loamy or sandy with considerable percentages of lime and organic matter. The majority of this land is irrigable from the 15 small streams which flow through it.

The climate is Mediterranean (1) and warmer during the winter than that of Monastir and Norina in the same latitude, owing to the surrounding mountains (2) which shelter it from the cold north and north-east winds, while the summer temperature remains cool owing to the currents of cold air from these same mountains. The atmosphere is very moist throughout the year, owing to the abundant rainfall and numerous streams.

The population of Meglena is about 125 per square mile and is ample to supply the labour requirements of this crop.

Rotations. — Capsicum follows maize or French beans in either of the two following rotations :

wheat	wheat
maize	maize
capsicum	French beans
	capsicum.

(1) The climatic conditions of Meglena are probably between those of Salonica and Monastir, which, according to DUPUY (Monastir 1899-1903) and to some observations of the Agricultural College at Salonica (1906-1910) are as follows:

Month.	Temperature, °C.		Rainfall in mm.	
	Salonica	Monastir	Salonica	Monastir
May	20.56	17	43.6	68.0
June	24.20	19	16.1	71.0
July	25.23	23	29.0	49.0
August	24.21	22	38.0	40.0
September	17.50	18	37.0	29.0

(2) For an account of the geological and physical conditions, see CVETIĆ, *Geographie und Geologie von Mazedonien und Altserbien.* — *Petermanns Mitteilungen, Ergänzungsheft* No. 162, p. 224 et seq. (Morichovo und Meglen). Gotha, 1908.

A three- or four-course rotation is necessary to maintain the fertility for this crop, and to check the progress of underground pests. On account of the large amount of labour required, it is a suitable crop for the small holder and for countries where labour is cheap and plentiful.

Cultivated varieties.— During the half century in which this crop has been grown on a large scale in Meglena, many varieties have originated and become adapted to the particular conditions of climate and soil in which they are grown. Each variety yields a product of special type of more or less good quality, varying according to the locality. Experiments have shown that these Meglena varieties lose a considerable part of their quality and piquancy when grown in other countries or even in neighbouring districts. The Grecian occupation being very recent, it has not been possible to study the relative conditions from the scientific point of view. It is only known that the products of highest quality come from the villages of Neochore, Fressino, Poziar and Stroúpino.

Two of these varieties are distinguished as common and sweet capsicum respectively.

Common capsicum is of commercial importance and is preferred by the cultivators on account of its higher yield. The fruit are very conical in shape with a length of 2 $\frac{1}{2}$ to 4 inches, and a diameter at the base of $\frac{3}{4}$ to 1 $\frac{1}{2}$ inch. The skin is rather thick, and 4 to 8 lbs. of fruit, according to the moisture content, are required to yield 1 lb. of pepper. This variety grows to height of 16 to 24 inches, and each plant produces only 40 to 50 fruits, owing to the reduction in irrigation during the season. The annual production of common capsicum reaches 2 to 4 million lbs. and increases each year.

Sweet capsicum.— The fruits of this variety are almost as large as those of the above, but the skin is thinner and the product is both piquant and sweet. It is cultivated only in the villages of Bakovo, Csernezi and Stroupino. At least 8 lbs. of dry fruits are required to produce 1 lb. of pepper, and although it realises higher prices in the market, it is a less profitable crop to cultivate than the common capsicum. The annual production reaches only 10 000 to 90 000 lbs. of pepper. Experiments have shown that the seeds of this variety grown in other villages produce plants with the characteristics of the common variety.

Preparation of nurseries.— The seeds are not generally sown in the open but in a cold pit, and afterwards transplanted. A sheltered plot is chosen and dug to a depth of 12 to 20 inches at the beginning of April. The surface soil is mixed with well decomposed manure and the seeds sown thickly towards the end of April. A thin layer of finely divided manure is then spread over the surface and the bed watered each evening until the majority of the plants have appeared. Later, waterings are given every 5 or 6 days according to the weather. Two days before transplanting they are given a thorough watering to facilitate the lifting of the plants. The seedlings are kept hoed and thinned to promote strong growth, and if at the time of transplanting they appear backward, a dressing of pigeon guano is given in the seed-bed.

Preparation of the land and planting out. — The best soils for capsicum are loams or sands containing humus, and capable of irrigation. The land is ploughed, and then harrowed five or six times to reduce it to as fine a texture as possible. It is then ridged and the irrigation channels cleaned out. Planting out takes place during June when the plants possess 4 or 5 leaves. The soil is irrigated and the plants are dibbled by hand in holes 6 to 8 inches apart on the ridges, which are 16 inches apart.

Irrigation and weeding. — After transplanting, the soil is irrigated every 3 or 5 days until the success of the plants is assured. The first weeding takes place a fortnight after the last irrigation, unless weeds are much in evidence before this time. When the plants are established, irrigation is withheld until the leaves show signs of drought. This point is of considerable importance, since irrigation at this stage may greatly injure the quality of the product, the piquancy being partially or wholly destroyed. Three or four days after this second irrigation the land is hoed again deeply and the plants earthed up. The next irrigation is made after the capsules have formed and before the plants appear as wilted as for the previous irrigation. If necessary, a final weeding is made, and then the plants are irrigated every 4 or 5 days.

Harvest and drying of the fruits. — The capsules are harvested during September and early October when they have assumed a dark red colour and when nearly all their moisture has evaporated. The ripening of the fruits takes place at intervals, and the harvest is generally divided into three periods according to the stage of ripening. In some villages with a warmer climate, where the autumn frosts come later, the crop is often all picked at one time at the beginning of October, when the majority of the fruits are very ripe and have acquired a better colour and a higher market value.

The fruits from the first picking may be dried in the sun if conditions are favourable, but generally they are dried in a special drying shed, containing a perforated wooden platform fixed at 55 to 60 inches from the floor. The capsules are dried on this in a layer not more than 20 to 24 inches thick, lest the colour and quality of the product should be damaged. Owing to risk of fire in houses, special drying sheds are generally used. Wood fires are used, the smoke of which develops the colour of the product. The process lasts from 7 to 17 days, and with slow drying at relatively low temperatures a finer product is obtained. The drying is said to be complete when the fruits are very fragile, and crackle. In order to completely dry the fruits, including the thick placenta, they are covered over and the temperature is raised for 48 hours. They are then collected, broken into small fragments by means of a stick and taken to the flour mills, where they are ground on a soft millstone.

Yield and returns. Control of purity. — The average yield of red pepper is from 1300 to 2200 lbs. per acre; from 5 to 8 lbs. of capsules are required to produce 1 lb. of common capsicum and from 8 to 10 lbs. for each lb. of sweet capsicum. Sometimes the broken dried fruits are sold under the name of "boicovo". The price of the powder fluctuates between

2 $\frac{1}{4}$ d and 4 $\frac{1}{2}$ d per lb. The largest market is Edessa (Vodena) in Hellenic, Macedonia, where it is sold in bags of 100 kg. (220 lbs.).

The best quality of red pepper has a bright rose-red colour, the dark red and reddish-green varieties being the inferior grades. The bright red colour is obtained by sun-drying or by slow continuous drying. If the fruits have been touched by frost before picking, they develop a greenish colour and lose their piquancy. Attempts to improve the appearance of the inferior grades by chemical treatment, have been prevented by the action of the Turkish Government during the last ten years. Before export the product is inspected at a central depot where a small sample is taken from each bag and tested for colouring matter by making an alcoholic extract and evaporating a little on a sheet of clean cigarette paper. Any chemical treatment of the product shows itself in different coloured stains on the paper, while the pure pepper gives a uniform pale red. All adulterated products are confiscated and destroyed, and the bags which are certified as pure are specially sealed to avoid their being opened before reaching their destination.

The cost of growing capsicum, including the drying, is £9 10s to £11 per acre, while the gross returns are from £13 to £17 10s.

528 - **Warm Baths for Forcing Strawberries.** — BAITEL, G. in *Revue Horticole*, Year 86, No. 9, p. 212. Paris, May 1914.

Young plants are obtained by rooting runners in small pots early in June and then planting out in the open. They are repotted in September and sheltered when necessary. Before forcing in November and December a small pad of straw or hay is placed round the neck of the plant and tied on so as to prevent loss of soil when the pot is inverted. The pots are then inverted on an iron grid over a tank of water at a temperature of 32 to 35° C. (89° to 95° F.) so that the leaves are submerged. After treatment in this way for from 6 to 8 hours, the plants grow more rapidly, produce more flowers and give a better yield of fruit.

FRUIT
GROWING.

529 - **Recent Work of the Royal Hungarian Central Ampelological Institute at Budapest.** — *Communication from DR. GYULA DE ISTVÁNFY, Professor at the University and Director of the Institute.*

(1). *Research on mildew in vines.* — Experiments have been conducted for more than 10 years; a new line was taken up in 1911 with the institution of infection experiments. A summary has been published in Hungarian, of which a French translation appeared in the *Annales de l'Institut ampélogique* (1). The chief results have already been published in the *Bulletin of Agricultural Intelligence and Plant Diseases* (2).

(2). *Researches on the relation between climatic conditions and mildew.* These have been completed after five years' work, and indicate the meteorological conditions favourable to the development of mildew, the course

(1) GY. DE ISTVÁNFY and GY. PALINKÁS: *Etudes sur le Mildiou de la Vigne*. Vol. IV, 1913, June, pp. 1-122, pl. I-IX. Budapest, 1912.

(2) See No. 1208, B. Oct. 1913.

(Ed.).

of the propagation of the disease during several years and the means of forecasting outbreaks (1).

3). *The Intelligence Department for reporting the spread of mildew.* — Established in 1911 on the initiative of the Director of the Institute. Data are collected with the assistance of diseased specimens sent to the Institute. Reports are published weekly in the papers indicating the districts where the climatic conditions are favourable to the outbreak of the disease. This work has made the Institute popular and considerably strengthened its work.

4). *Information relating to defensive measures* (with coloured illustrations). These appeared in 1912 in new publications; of the articles relating to the control of mildew 12 000 copies were distributed in 5 700 vine-growing districts.

5). *Experiments in the control of mildew.* — The agricultural value of ten remedies used in various countries was determined in two series of experiments carried out in 8 and 10 State vineyards respectively. The Institute undertakes the testing of all acceptable remedies during a period of three years under the most varied climatic conditions.

6). The origin of "bramble-leaf", frozen stocks, the preparation of grafts, their treatment and preservation from a mycological point of view, have been studied. The publication of this work was completed during 1913.

7). *Researches on the degeneration of vineyards in certain districts.* — Considerable work was done during 1912-13, especially in the sandy region of the Alföld. The subject was studied from the point of view of anatomy, biology, pathology, meteorology and pedology. The chief causes of the degeneration are drought, frost, exhaustion of the vines, neglect, and damage due to attacks of cockchafer grubs and phylloxera. Good results have been obtained in the experiments in the mountain districts of Tokay-Hegyalja and at Somlyóhegy. A collection of phytopathological studies is in course of preparation, together with an account of the methods of examination used by the Institute.

8). *The control and examination of the means of destruction* is one of the most important works of the Institute, and deals with all the remedies in use. In 1912, 103 specimens were examined and 360 determinations made. The biological and phytopathological effect of new remedies is previously tested on vines under glass before experimenting in vineyards. Experiments have also been made on the use of carbon tetrachloride against phylloxera in four vineyards. Spraying materials have been tried in 8 cases and 142 determinations made, and the value of the "Tempus" sprayer was also determined in the experiment fields of the Institute at Kőbánya.

9). *Studies on defects of wines* are in course of publication. They relate to: a) the examination of acetification of wines, brought about by 26 different acetifying bacteria; the best varieties for the production of vine-

(1) See No. 68, B. Jan. 1913.

(Ed.)

gar were chosen; *b*) detailed researches on lactic fermentation, which, according to results obtained at the Institute, is the cause of numerous defects of wine; *c*) the examination of the organisms of must, showing that the organisms causing the diseases of wine are already present in the must; this led to an examination of the sulphuring process and the fermentation of the must by yeast; *d*) the study of the flavour of Hungarian wines known as "levegő íz" (air flavour), which has shown that yeasts play an important part in producing substances which influence the flavour and aroma of wines.

10). *The practical application of yeast cultures.* — After studying in detail the action of the various yeasts in the chief vine-growing districts, the Institute placed these yeasts at the disposal of wine-makers in 1912 and 1913. The yeasts included: 1) those producing a high alcohol content, for "Aszu" wine; 2) organisms giving a good fermentation even at low temperatures; 3) organisms settling to the bottom of the liquid and suitable for champagnes; 4) organisms capable of fermenting must containing a considerable quantity of sulphurous acid; 5) highly resistant organisms; 6) organisms which rapidly form a thick scum when alcoholic fermentation is complete; 7) organisms for fermenting red wines. Some 45 000 gallons of must were fermented, and in the majority of cases better wines with higher prices were obtained. In the autumn of 1913, this procedure was continued on a larger scale. As the result of experiment it was found that the best condition for despatching the yeasts was absorbed in sterilised cotton wool, in which condition they retained their vitality after 4 or 5 months.

A description of the properties of the 54 varieties of ferments so far selected, and a determination of the maximum quantity of alcohol produced in musts of different concentrations of sugar, are in course of progress.

11). *Experiments in vine-growing* are being carried out in State vineyards in different districts, with the object of determining the most suitable time for pruning; these experiments will be terminated in 1915, after six years' duration. At the same time the composition of the bleeding sap is determined by chemical analyses (34 in 1912). Hengl's new grafting machine was also tried from the point of view of perfecting the work, and as a result of the anatomical examination of the joint and the graft it was concluded that this machine could not efficiently replace hand grafting on a large scale.

12). *Manurial experiments* to compare the value of different excreta have been carried out since 1909. In 1912 additional experiments were begun, comprising 360 chemical analyses of 86 samples of must. Further, analyses have been made of the fertilising value of grape pomace, tobacco refuse, brewers' hops, sawdust, etc. Experiments with chemical manures in 1912 were designed to establish the most suitable mixtures for large areas of soil types; these experiments are being conducted at present in 7 districts.

13). Experiments with different types of stakes have been made.

14). Smudging against frost has been tried in four State vineyards.

15). *Experiments with hybrid stocks*. — Nine experiment fields were started in 1912 in various localities of Hungary, and others are contemplated. Three nurseries have been established in different districts for the propagation of stocks. Observations have been made of 70 plantations of hybrids in 12 different counties, with respect to the suitability of hybrids to certain conditions of soil, particular attention being paid to the difficulties of treating the soil with carbon disulphide. Various binding materials, such as raphia, bast and jute, have also been tried.

16). *The Hungarian Ampelography*, describing all the more important vines, with colour-photographs, is nearing completion.

17). *Publications*. — The *Annuaire* has been discontinued, and popular articles are published in *Borászati Lapok*. Vol. IV. of the *Annals* containing only technical articles has appeared, and the French edition will soon be out.

18). *Vine-growing and meteorological stations*. — There are 11 of these at work under the Institute; the results given by them, especially as to mildew, have been very useful. Their climatological data for 1901-08 have recently been published under the title of *Réthy Antal* (142 pp.).

19). *Observations on the development and phenology of the vine* were carried on by means of schedules in 1912; the observations now extend over twelve years.

20). *Ampelographical Collection*. — This is situated at Kőbánya, near Budapest; it contains 600 varieties. The Institute also possesses a vineyard near Orsova, far from any vine district, where imported varieties are increased; these are then used for hybridization, chiefly to obtain adaptable stocks.

21). The information department replied, in 1912, to 3385 enquiries on all branches of vine-growing and wine-making.

530 — **The Growth of the Roots of the Vine and its Importance in the Manuring and Cultivation of the Soil of Vineyards**. — KROEMER in *Zeitschrift für Weinbau und Weinbehandlung*, Year 1, Parts 1 and 2, pp. 37-46 and 70-81. Berlin, 1914.

The writer describes the development of the root-system of the vine, particularly the active portion, and its relation to the physical properties of the soil. He concludes that the most favourable conditions for the development of the active root system occur in the upper layer of soil and that the deeper root system is concerned with the absorption of water rather than food material, though the more soluble constituents, such as the nitrogenous ones for example, may also be absorbed by these deep roots.

Consequently the removal of superficial roots as generally carried out is injurious to the plants, and appropriate cultural methods ought to be employed instead which would encourage the development of surface roots in addition to the deeper root system.

For the first few years after planting the soil should be cultivated deeply while the deep root system develops. In older vineyards on fairly moist soil the superficial root system can then be stimulated without danger to the plants, and care should be taken not to disturb the surface soil.

by carrying out only very shallow tillages. The same treatment may be adopted in the case of soils with a high water-table. On the other hand, in light, permeable dry soils with a low water-table, and especially in districts of low rainfall, deep cultivation should still be practised to develop a deep penetrating root system.

531 - **Protection of Vines against Spring Frost.** — LUR-SALUCES in *Bulletin de la Société des Agriculteurs de France*, Year 16, pp. 265-267. Paris, April 15, 1914.

A system of protection against spring frosts was organised in the district of Sauternes (Gironde) in 1913, with good results. The land of each commune was divided into a number of sections; in each commune one of the growers volunteered to give the alarm: he fires a cannon at nightfall if a frost seems likely, then three shots when the fires are to be lit, and three more in the morning when the temperature rises above freezing-point.

Fire places are fixed in the alleys of each section at intervals of 10 to 30 yds., and besides them one cauldron on wheels is supplied for every 12 acres or so; this moves up and down in a cross shape. The cauldron is half full of coal tar, which is lit by means of pine branches; it is occasionally sprinkled with water to increase the denseness of the smoke. The fixed fires are made of green pine branches, litter, green grass, etc. By this means a very dense smoke was obtained, so that it was difficult to find one's way about; this completely prevented further radiation from the ground. In case there is much current of air, it is well to have extra cauldrons producing smoke on the windward side.

At Preignac, in 1913, the cost of smudging on three mornings in April for about 5 hrs. each was about 3s 6d per acre for materials alone.

532 - **The World's Trade in Bananas.** — MACFARLANE, JOHN I. in *The Tea and Coffee Trade Journal*, Vol. XXVI, No. 3, pp. 226-230 + 6 figs. New York, March 1914.

I. — *Importing countries.* — *United States.* This country is the world's greatest consumer of bananas. During the fiscal year ending June 30, 1913, \$ 28 657 084 worth of fruit were imported, more than half of which consisted of bananas. The latter were imported chiefly from the regions bordering the Caribbean Sea, as shown in the following table:

Imports of Bananas to the United States, 1912-13.

	No. of bunches	Value \$
Jamaica	11 163 269	3 488 498
Honduras	7 983 591	2 435 006
Costa Rica	6 973 684	2 744 813
Panama	4 438 300	2 082 502
Guatemala	2 359 250	600 041
Columbia	2 684 749	1 107 429
Cuba	2 213 733	834 206
Nicaragua	1 681 944	348 064
Mexico	1 541 504	412 315
British Honduras	651 054	163 249
S. Domingo	475 500	222 626
Guiana	184 498	39 932
Grenada	4 398	4 111
Other regions of the West Indies	1 625	466
Total	42 357 109	14 484 258

Half of the bananas imported to the United States enter through the port of New Orleans, which receives more bananas than any other port in the world and possesses special facilities for landing the fruits.

The value of the bananas imported to *Europe* is almost equal to that of the United States, but the quantity is only about one-third. England, France and Germany are the most important consumers in Europe.

England is second to the United States in imports of bananas, which are increasing rapidly.

	No. of bunches	Value — \$
1900.	1 287 000	2 740 000
1912.	6 978 876	9 587 000

Germany imports 35 226 000 kg., valued at \$2 525 000, while *France* received 21 749 000 kg., valued at \$1 219 000.

II. *Exporting Countries*.— *Jamaica* comes first in the exportation of bananas:

1911.	16 947 385 bunches
1912.	13 382 072 "

The decrease in 1912 is attributed to accidental causes.

Costa Rica comes second, with an export of 10 647 000 bunches, and shows an increasing production.

Honduras is rapidly increasing her exports to the United States, and *Panama* has doubled her exports during the last ten years.

The *Canary Is.*, which were formerly the chief exporters to Europe, maintain their exports at about 2 723 000 bunches.

533 - *Citropsis*, a New Tropical African Genus allied to *Citrus*. — SWINGLE, WALTER and KELLERMAN, MAUDE in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 420-436 + 7 figs. + 1 plate. Washington, February 1914.

The fruits of *Citropsis* are known as "African cherry oranges"; they are produced in clusters from the axils of the leaves. The writers consider it necessary to establish a new genus to include these African species, and they do this by raising the section *Citropsis* of Engler to generic rank. The following species are described: *C. Preussii* (Engler), *C. Schweinfurthii* (Engler), *C. gabunensis* (Engler) and *C. mirabilis* (Chev.), as well as *C. articulata* (Willd.) which is not well known.

The members of this genus are worthy of the attention of agriculturists, since several of them produce an abundance of delicious fruits. *C. Schweinfurthii* has given good results on poor sandy soils in Florida. It is hoped that the numerous small fruits may be increased in size by hybridization with *Citrus*; successful crosses have already been obtained.

LIVE STOCK AND BREEDING.

HYGIENE

534 - **Research on the Life History of the Large Warble Fly (1) and Means of Controlling it.** — LUCET, ADRIEN in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 158, No. 13, pp. 968-970. Paris, March 30, 1914.

The writer communicates further investigations into the life history of the large warble fly. The adult fly lives only until it has mated and deposited its eggs.

In eleven flies, observed by the writer, the average duration of life was from four to five days. During this time the fly does not seem to take food. It does not appear either to travel any distance from the place where it was hatched, flying only in fine, warm weather, and not moving in the mornings, evenings or cool wet weather. The number of eggs which were found in the bodies of four females were : 372, 386, 357 and 343, which is less than the number found by GLÄSER. Recently-laid eggs contained the larvae already clearly formed.

Neither placing adult flies on the neck and back of an ox nor enclosing the ox with some flies in a cage for several days appeared to alarm the animal, from which the writer is led to believe that the gadding of cattle is not caused by warble flies.

The writer also undertook experiments for the control of warbles and obtained very satisfactory results with tincture of iodine prepared according to the pharmacopoea. An injection of 0.5 and 1 cc. of pure or diluted tincture of iodine (Gram solution) practised on the swellings of two oxen had the result of killing all of the 81 larvae they contained. These experiments were to be continued in May in the Département of Ariège.

535 - **Practical Observations on Contagion in Anthrax of Cattle, on the Diminution of Cases by Vaccination and on Uniform Immunization.** — VIASZ, J. in *Allatorvosi Lapok*, XXXVI, No. 30, pp. 355-358. Budapest, 1913.

The writer reports on his results obtained from the dissection of 1200 cattle and from the clinical observation of about 250 diseased ones. Contrary to the generally accepted opinion, according to which the food is credited with being the chief source of contagion, the writer believes that at least 80 per cent. of the cases are due to the drinking water. In support of his opinion he mentions instances of large estates and communes in which only the animals that drank the water from certain sources fell ill and the disease disappeared as soon as these sources were closed. Infection by wounds in the skin is possible, but it is so rare that it can be practically neglected. Where, on the contrary, infected water exists, the disease may attack stall-fed animals also, and exceptionally even buffaloes.

As for the age, it has been observed that in such localities not only steers contract the disease, but also calves immediately after weaning, and this so frequently that they must be regularly vaccinated at that time. In order

(1) See No. 144, B. Feb. 1913; No. 251, B. March 1914; No. 445, B. May 1914.

to avoid cases of sickness due to the inoculation, it is recommended to grind very fine the powdered matter used for vaccinating, as by this means it can be more exactly dosed. Only the matter obtained from the liquid contained in the swellings is suitable for this purpose, as that obtained from the muscles cannot be reduced to a uniform powder.

Observing this method, 5000 head of cattle have been inoculated in the course of eight years without any losses, and only in the ninth year did two deaths occur shortly after inoculation.

For the treatment of diseased animals intravenous injection of hydrogen peroxide, followed by the incision and washing out of the swellings, is recommended. As a prophylactic measure immediately on the outbreak of the disease, a search should be made for infected wells or other sources of water.

536 - **Swine-pox in Young Pigs.** — BÄN, E. in *Allatorvosi Lapok*, Year XXXVI, No. 52, pp. 620-621. Budapest, December 27, 1913.

The existence of swine-pox was until recently considered doubtful. Chauveau, Gerlach and R. Koch had, however, demonstrated that cow-pox can be artificially communicated to pigs, but under natural conditions the disease had hardly ever been observed. In 1906 Száutó proved that pigs, especially sucking ones, sometimes contract the disease and that they communicate it to healthy animals by merely living with them. Since then, from year to year the number of observations has increased and it appears that in many districts of Hungary the disease is fairly frequent, that it attacks some herds every year and that sometimes it causes considerable losses. This is especially true of districts on the right bank of the Danube, where, according to the writer's observations, it is one of the most frequent diseases of sucking pigs. Generally it develops so insidiously that the owner is only aware of its presence when a proportion of the weaned pigs are arrested in their development or some of them die. When the herds are once infected it is very difficult, as with cow-pox, to free them again, even making use of repeated disinfections.

The disease is accompanied by severe itching, which leads to the production of an eczema. The course of the attack is generally mild, but sometimes serious losses occur, mostly through complication with intestinal catarrh or chronic catarrhal pneumonia. In one herd the necrosis of the teats was observed, but it is not certain that this complication was caused directly by the disease. Protective inoculations with cow-pox lymph gave good results in several localities on about 400 young pigs. Small nodosities were formed at the place of inoculation, but otherwise the animals' health was in no wise impaired. In one case, a few pigs developed small pustules on the inner side of the thigh, where they had been inoculated, and after 6 or 8 weeks all the other animals fell ill, but not seriously. It is not impossible that these inoculations, which of late have been more frequently practised, may have contributed to the spread of the disease.

- 537 - **Causes and Effects of Cryptorchism.** — ZSÁMÁR, GEORGE in *Allatorvosi Lapok*, Year XXXVII, No. 6, pp. 61-64, No. 7, pp. 74-78, No. 8, pp. 90-95. Budapest, February 7, 14, 21, 1914.

With the object of throwing more light on the question of the procreative power or the sterility of cryptorchids, the writer subjected eight testicles which had been retained by monorchid horses to a rigorous histological investigation as to their sperm-producing capacity.

The result of his investigations can be summarized as follows: Independently of whether the testicles had been retained in the abdomen or in the inguinal canal, and of the age of the animal within the limits of 2 to 3 years, the germinative cells in the tubuli are represented only by earlier stages of development, as spermatogones or at most spermatocytes. Such testicles therefore resemble normal testicles in young animals, with the essential differences that in the former degenerative processes point to the cessation of development, while in the latter the conditions for further development exist. The degeneration concerns more the germinative cells than Sartoli's cells, while the so-called plasm cells on the contrary seem more numerous.

The formation of sperm in the retained testicles does not reach the degree of being vital and fertilizing; consequently stallions that are completely cryptorchid must be considered as sterile and monorchid stallions as owing their generative power only to the testicle which has descended normally into the scrotum.

If the male sexual characters are well marked in completely cryptorchid horses, this is explained by the fact that the so-called plasm cells which produce the inner secretion have not suffered any degeneration.

- 538 - **Sugar in Blood Plasma.** — BERRY, H. and FANDARD, L. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 158, No. 1, pp. 61-64. Paris, January 5, 1914.

The blood of horses, chickens and dogs was examined for sugar, and it was found that venous plasma was always richer in sugar than the corresponding arterial plasma.

ANATOMY AND PHYSIOLOGY

- 539 - **Influence of Fluorine on the Animal Organism.** — SCHWYZER, F. in *Biochemische Zeitschrift*, Vol. 60, Part I, pp. 32-42. Berlin, February 14, 1914.

Experiments with rabbits led the writer to conclude that fluorine introduced into the body caused a loss of lime, chlorine and fat from the bones; even in daily doses inferior to one millionth of the live weight it acts as a poison, and consequently is strictly to be avoided for preserving mashes for live stock and similar uses.

FEEDS AND FEEDING

- 540 - **The Food Value of Certain Grasses.** — GRÉGOIRE, A. and CARPIAUX, E. in *Rapports et Communications du Ministère Belge de l'Agriculture et des Travaux Publics*, No. 8, pp. 5-48. Brussels, 1914.

The following grasses, Italian ryegrass (*Lolium italicum*), English ryegrass (*Lolium perenne*), tall fescue (*Festuca elatior*), tall oat grass (*Arrhenatherum elatius*) and timothy (*Phleum pratense*), were investigated from two points of view: 1) their food value, and 2) the assimilation by the animal of lime

TABLE I. — Chemical composition of hay (per cent.).

	Dry matter		Crude protein		Crude fat		Nitrogen free extract		Crude fibre		Ash		Pure protein		Phosphoric acid		Lime	
	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)	Grégoire	Pott (mean)
<i>Italian ryegrass:</i>																		
1st cut (Sep. 8, 1908) . . .	85	86.8	8.76	9.9	2.5	3.1	44.61	43.4	20.21	22.9	9.38	7.5	7.93	—	0.814	—	0.728	—
2nd „ (June 15, 1909) . . .	85		4.43		0.98		50.20		24.00		5.40		3.77		0.456		0.418	
<i>English ryegrass:</i>																		
1st cut (Sep. 8, 1908) . . .	85	86.0	10.18	9.1	2.32	2.0	39.72	34.7	23.42	33.8	9.36	6.4	8.95	—	0.921	—	0.683	—
2nd „ (June 15, 1909) . . .	85		5.24		1.16		46.51		25.76		6.33		4.21		0.513		0.417	
<i>Tall fescue:</i>																		
1st cut (Sep. 8, 1908) . . .	85		10.51		1.97		43.30		21.56		7.67		9.17		0.761		0.586	
2nd „ (June 15, 1909) . . .	85	85.7	6.91	8.0	2.25	2.3	43.34	42.3	24.67	26.0	7.83	7.0	5.99	—	0.573	—	0.354	—
3rd „ (July 12, 1909) . . .	85		5.55		2.12		39.97		26.55		10.52		4.26		0.462		0.354	
<i>Tall oat grass:</i>																		
1st cut (June 3, 1910) . . .	85	86.8	5.07	6.2	1.18	1.9	34.97	41.7	35.13	29.5	8.65	7.6	4.30	—	0.534	—	0.282	—
2nd „ (Sep. 6, 1912) . . .	85		5.47		1.38		37.51		31.89		8.77		4.39		0.633		0.378	
<i>Timothy:</i>																		
(July 13, 1910) . . .	85	87.3	4.54	7.6	0.72	2.3	45.20	45.3	27.90	27.4	5.92	4.7	4.22	—	0.388	—	0.371	—

TABLE II. — *Results of digestibility trials.*

Kind of hay	Percentage digestibility: mean of 3 sheep.					
	Dry matter %	Organic matter	Crude protein	Crude fat	Nitrogen free extract	Crude fibre
<i>Italian ryegrass:</i>						
Cut young	82.15	74.6	56.4	53.4	79.1	73.7
Cut in flower	80.32	58.7	26.4	36.4	68.0	46.2
<i>English ryegrass:</i>						
Cut young	80.06	76.0	62.1	53.1	80.6	76.6
Cut in flower	80.93	59.8	40.9	48.9	64.7	55.1
<i>Tall fescue:</i>						
Cut young	83.28	70.7	63.2	55.9	75.4	67.7
Cut in flower	84.42	63.3	53.6	73.0	64.3	53.5
Cut after flowering	87.84	56.7	51.0	82.6	62.1	47.0
<i>Tall oat grass:</i>						
Cut young	85.47	57.8	46.5	52.3	54.4	63.9
Cut in flower	85.90	56.4	43.7	48.7	47.5	66.3
<i>Timothy:</i>						
Cut after flowering	83.93	54.4	37.1	60.1	62.5	43.9

and phosphoric acid contained in the grasses. The first three were sown on an old experimental field at Gembloux in May 1908; no manure was applied, a good set was obtained and the first crop cut in September 1908 under good weather conditions. In April 1909 the plots received 180 lbs. of nitrate per acre, and half of each plot was cut on June 15, the hay being got up in good condition, while the other half was not cut till later and made in bad weather. The other two grasses were also sown on an old experimental field at Gembloux, but on land in good heart. Seed was sown in 1909 and came up normally; 180 lbs. of nitrate were applied in April. A good crop of tall oat grass was obtained, but only a moderate one of timothy.

Food value of hay. — Feeding trials were carried out on sheep in KÜHN feeding boxes similar to those in use at the Möckern Experimental Station; the faeces and urine were also collected by the same system as employed at Möckern. The trials lasted a fortnight after a preliminary preparatory period of a week. The hay was chaffed and carefully mixed with other foods, samples being analysed by Belgian official methods with slight modifications. The results are tabulated in Table I and compared with those obtained by PÖRR for similar plants.

The two sets of figures are somewhat different: the two kinds of ryegrasses and timothy contain less albuminoids and the two former more nitrogen-free extract than PÖRR's samples and the percentage of fibre in English ryegrass is also lower; tall oat grass is poorer in nitrogen-free extract

TABLE III. — Average amount of total organic matter and digestible matter (and their starch value) provided per day and per 1000 kilog. live weight in the different kinds of hay (in kilog.).

Kind of hay	Total organic matter	Digestible material				Starch Value
		Crude protein	Crude fat	Nitrogen free extract	Crude fibre	
<i>Italian ryegrass :</i>						
Cut young	15.984	1 043	0.231	7.456	3.037	8.3
Cut in flower	14.200	0 209	0 064	6.105	1.975	5.7
<i>English ryegrass :</i>						
Cut young	15 448	1 293	0.252	6.533	3.667	8.4
Cut in flower	14.642	0.398	0.105	5 607	2.647	5 9
<i>Tall fescue :</i>						
Cut young:	16.298	1.400	0 233	6.884	3.080	8 8
Cut in flower	15.285	0.729	0.328	5.452	2.602	6.4
Cut after flowering	15 823	0 583	0.425	5.303	2.556	5.8
<i>Tall oat grass :</i>						
Cut young	15.172	0 506	0.143	4.028	4.053	5.0
Cut in flower	13 316	0.386	0.100	2.826	4.055	3.8
<i>Timothy :</i>						
Cut after flowering	15.502	0.309	0.159	5.184	2.239	3.9

but richer in cellulose. These differences show how the composition of hay may vary from year to year and the very approximate value of figures in recognised tables.

Results of digestibility trials are given in Table II, and in Table III the average amount of total organic matter and digestible material (together with their starch values) provided in the rations per day and per 1000 kilog. live weight.

KELLNER's maintenance ration for an adult sheep is as follows:

Dry matter	18.23 kilog
Crude digestible protein	1.20 "
" " fat	0.20 "
Nitrogen-free extract + fibre	10.50 "
Starch value	8.30 "

Of the experimental rations the two ryegrasses and the tall fescue were the only ones which supplied amounts of food elements up to KELLNER's standard, and Table IV gives the gain or loss of nitrogen undergone by the animals calculated from the difference between the nitrogen digested from the food and that excreted in the urine and stated as loss or gain of protein per day and per 1000 kilog. live weight;

TABLE IV. — *Loss (—) or gain (+) of protein to the animal body in gms. per day and per 1000 kilog. of live weight.*

<i>Italian ryegrass:</i>	
Cut young	+ 256
Cut in flower	— 34
<i>English ryegrass:</i>	
Cut young	+ 322
Cut in flower	+ 25
<i>Tall fescue:</i>	
Cut young	+ 153
Cut in flower	+ 74
Cut after flowering	+ 93
<i>Tall oat grass:</i>	
Cut young	— 43
Cut in flower	+ 44
<i>Timothy:</i>	
Cut after flowering	+ 8

The present results would seem contradictory to those obtained by KELLNER, but the discrepancy may be explained by the fact that KELLNER's maintenance rations are not minimum but maximum maintenance rations, *i. e.* that any increase will cause the animal to put on weight, and, consequently, the rations can be reduced within certain limits without causing the animal to actually lose weight.

The digestibility coefficients obtained in the present trials are tabulated in Table V and also stated as percentages of the hay made from young grasses. KELLNER's digestibility coefficients for hay made from grass in flower (Table VI) differ considerably from these results. He places English rye grass below Italian with regard to digestibility, while the order is reversed in the present results. The variation in digestibility makes it difficult to judge of the relative value of the plants on this basis, but the remarkable digestibility of tall fescue may be pointed out. As the time of cutting advances the digestibility decreases, but even in this decrease there is considerable variation with the different species; with tall oat grass the decrease is small, while with the ryegrasses and the fescue the decrease amounts to 25 per cent., and of the nutrient elements protein suffers the largest proportional loss. Considering both digestibility results and the production per acre, the value of the above grasses as fodder plants may be classed in the following order: 1) tall fescue, 2) English rye grass, 3) Italian rye grass, 4) tall oat grass, and 5) timothy.

Mineral matter. — It is impossible to determine digestibility coefficients for the various mineral elements on account of the large experimental error which would occur due to the interchange of salts in the animal organism; a balance can only be struck between amounts fed and amounts excreted. This balance showed a considerable loss of lime to the animal body when the ration consisted entirely of grass hay, fescue and timothy causing least loss. The writers analysed the urine for silicic acid and were

TABLE V. — *Digestibility coefficients.*

Kind of hay	Organic matter		Protein				Crude fat		Nitrogen-free extract		Crude fibre	
			Crude		Pure							
	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative	absolute	relative
<i>Italian ryegrass</i>												
Cut young	74.2	100	56.4	100.0	51.8	100.0	53.4	100.0	79.1	100.0	73.7	100.0
Cut in flower	58.7	78.7	26.4	46.8	13.5	26.1	36.4	68.1	68.0	86.0	46.2	62.7
<i>English ryegrass</i>												
Cut young	76.0	100.0	62.1	100.0	56.8	100.0	53.1	100.0	80.6	100.0	76.6	100.0
Cut in flower	59.8	78.8	40.9	65.9	26.5	46.2	48.9	92.1	64.7	83.6	55.1	71.9
<i>Tall fescue</i>												
Cut young	70.7	100.0	63.2	100.0	57.9	100.0	55.9	100.0	75.4	100.0	67.7	100.0
Cut in flower	60.3	85.3	53.6	84.8	46.0	79.6	73.0	130.6	64.3	85.3	53.5	79.0
Cut after flowering	56.7	80.2	51.0	80.7	37.0	64.0	82.6	147.8	62.1	82.4	47.0	69.4
<i>Tall oat grass</i>												
Cut young	57.8	100.0	46.5	100.0	33.2	100.0	52.3	100.0	54.4	100.0	63.9	100.0
Cut in flower	56.4	97.6	43.7	93.8	33.5	100.0	48.7	93.1	47.5	87.3	66.3	103.7
<i>Timothy</i>												
Cut after flowering	54.4	—	37.1	—	32.2	—	60.1	—	62.4	—	43.9	—

TABLE VI. — *Kellner's digestibility coefficients.*

Kind of hay	Protein		Fat	Nitrogen free extract	Crude fibre
	crude	pure			
<i>Italian ryegrass</i>	63.4	54.4	43.8	65.5	65.1
<i>English ryegrass</i>	50.0	39.3	29.9	55.1	51.0
<i>Tall fescue</i>	50.0	38.4	29.9	53.7	53.1
<i>Timothy</i>	47.1	41.6	41.7	62.0	53.0

led to believe that the two following causes might account for the observed loss of phosphoric acid and lime :

1. The acidity of the ash of grasses, due more especially to silicic acid, produces an eminently toxic effect ; silicic acid goes into the circulation, where, notwithstanding its weak acid properties, it plays an important part, causing a loss of mineral bases and eventually even of phosphoric acid.

2. The movement of phosphoric acid is regulated by that of the lime with which it is intimately connected. It would therefore appear that the insolubility of the phosphoric acid in the ash of grass is an important factor, making it difficult for the animal to make good the losses which follow as a consequence of the lime drainage caused by the silicic acid.

The mineral matter of a ration composed solely of grass hay should therefore be supplemented. In practice this is usually done by adding to the ration fodders with alkaline ash, such as leguminous fodders or roots, but failing these means, calcium carbonate should be added. The writers carried out some trials in which calcium carbonate was introduced into the ration, and observed that the latter substance in no way diminished the digestibility of the grasses, while it prevented the losses of lime and phosphoric acid to the animal body, so that a small gain was actually recorded.

CONCLUSIONS.

1. The figures given in tables of food values cannot be more than approximately accurate in so far as they deal with hay made from certain grasses.

2. The digestibility of hay decreases with the increase in age of the grasses from which it was made, but the amount of decrease varies considerably with the different species, which may be placed in the following ascending order : tall oat grass, tall fescue, English ryegrass, Italian ryegrass.

3. The food value of various hays differs considerably from that given by KELLNER. Tall fescue heads the list and is followed by the two ryegrasses and tall oat grass.

4. A ration composed solely of hay made from grasses causes losses of phosphoric acid and lime to the animal organism, more especially when

the hay is cut very young. The chief cause for this would appear to be the silicic acid present in the grasses, and possibly also the low solubility of the phosphoric acid.

5. The addition of calcium carbonate to the ration has no effect on its solubility, but reduces the losses of phosphoric acid and lime.

541 - **Bacteriological Research on Ensilaged Forage** (1). — GORINI, C. in *Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. II, pp. 165-179. Milan, 1911.

As a result of ten years' investigation on the subject, the writer distinguishes four types of silage :

1. Silage in which butyric acid bacteria predominate.
2. Silage in which lactic acid bacteria predominate.
3. Silage in which putrefying bacteria predominate.
4. Silage comparatively free from bacteria.

The first two may be considered normal types, the remaining two abnormal types of silage. Abnormal silage may be produced either when the temperature of fermentation is too low, which favours the development of putrefying bacteria, or when the temperature is too high, which destroys all bacterial life; consequently the making of successful silage depends chiefly upon the amount of heat produced in the silo, which may be controlled by the packing, and only to a lesser extent upon the moisture content and quality of the forage. The optimum temperature for the silo is 50° C. (122° F.), at which temperature lactic acid bacteria predominate; if the temperature rises to 60° C. (140° F.) the butyric acid flora is especially favoured.

With regard to the question as to whether it is advisable to classify silage as "sweet" and "sour", the writer observes that strictly speaking all silage is more or less acid and that consequently it should all be classified according to the degree and nature of its acidity, though it does not follow that the quality of the silage can always be determined from its degree of acidity: the rule holds good only within certain limits.

Opinions are still divided with regard to the relative value of the two types of silage for food in general, but when fed to dairy cows the writer gives preference to the lactic acid type, as the butyric acid type is liable to taint the milk and butter.

The writer has also carried out some experiments on seeding pure cultures of lactic bacteria into the silos. The experiments are not yet completely finished, but the results obtained up to the present lead to the following conclusions:

1. That the addition of lactic acid bacteria to the silo improves the keeping qualities of the silage.
2. That different lactic acid bacteria act differently upon the silage.
3. That even at a relatively low temperature it is possible to make so-called sweet silage.

(1) Cf. *Ricerche Batteriologiche sui Foraggi conservati nei Silos*, by the same writer, for the years 1906, 1908, 1909, 1910, 1912. Premiata Tipografia Agraria, Milan. (22)

542 - **Toxic Bran.** — MARCHADIER and GOUJON in *Annales des Falsifications*, Year 7, No. 64, pp. 77-81. Paris, February 1914.

Bran undergoes degenerative changes on storage which may be the cause of serious disturbances when it is fed to animals. In order to find a method of determining whether any given sample of bran be fit for food, the writers carried out the following experiments: 100 tons of fresh bran were put into a heap in November 1912; in the following February the formation of lumps was observed, while in March the temperature had risen considerably and the centre of the heap was carbonized. Samples were drawn 1) from the outside of the heap which was in friable lumps but not discoloured, 2) from a little further in where the lumps were less friable and dun coloured, and 3) from the centre where the bran had become a compact black mass yielding a fracture rather like that of linseed cake made under high pressure, and looking and smelling of roasted chicory. A sample of the same bran kept apart from the heap was also taken, as well as a fresh commercial sample. They were all analysed and yielded the following results.:

	Commercial sample	Bran not put in heap	Bran from the outside of the heap	Bran from lower layers of the heap	Bran from centre of the heap
Moisture	12.7	14.8	13.6	11.6	11.5
Acidity as { total	0.074	0.172	0.211	0.776	2.062
{ fixed	0.074	0.172	0.211	0.578	1.445
{ volatile	0.000	0.000	0.000	0.198	0.617
H ₂ SO ₄ {					
Fat	1.32	1.70	1.10	2.64	4.98
Ash	5.5	5.8	5.9	6.0	6.2
Anaeroidase	present	present	present	absent	absent
Soluble in cold water	10.65	12.35	4.35	9.80	18.30

The acidity increases as fermentation proceeds, so that at the end of the process the acid content is fifteen times as high as it was originally, and the oxidising enzymes disappear in the later stages of fermentation. The writers suggest that these two factors be taken as a base for determining whether bran be fit for food, classing the bran as follows:

	Acidity
Normal bran	below 0.150
Bran undergoing decomposition, not yet unfit for food but liable to become so very rapidly.	0.150 to 0.300
Bran unfit for food	above 0.300

543 - **The Rate of Liberation of Hydrocyanic Acid from Linseed** (1). — COLLINS, S. H. and BLAIR, H. in *The Analyst*, Vol. XXXIX, No. 455, pp. 70-72. London, February 1914.

Linseed was digested with water to which other substances were added experimentally and the resulting hydrocyanic acid, when formed, was removed, by a stream of hydrogen gas, absorbed in weak caustic soda solution and estimated colorimetrically by the prussian blue test. One particular sample of linseed yielded 0.38 mgm. of hydrocyanic acid per gm. of linseed. The velocity of reaction was such that one half of the total amount was yielded in 46 minutes, whereas solutions of hydrocyanic acid in water yielded one half the total amount in 26 minutes, reaching in 3 hours' time from 98 to 99 per cent. of the total amount present. When the linseed was acidified to represent digestive conditions, no hydrocyanic acid was liberated, and similar negative results followed the use of pepsin and rennet in acid solutions. Even hydrochloric acid of $\frac{N}{100}$ strength prevented the enzyme from working, and $\frac{N}{1000}$ strength produced a marked slowing in the rate of liberation of hydrocyanic acid from linseed.

With non-ruminant animals the acidity of the stomach would render the enzyme inactive. In the case of cattle where 2 to 3 lbs of linseed may be fed daily, the writer attributes the usually innocuous effects partly to the influence of other foods in slowing down the action, and partly to the fact that the hydrocyanic acid formed must be largely evaporated into the air during rumination with its attendant continual regurgitation of the food into the mouth. The linseed "mash" fed to calves is a more likely source of danger. Linseed treated with a large volume of boiling water and kept at 100° C. for half an hour produced no hydrocyanic acid gas, but at 60° the evolution of acid was only slightly checked, though almost completely checked at 90° C.; linseed heated dry to 100° C. or ground finely produced an increased amount of hydrocyanic acid. Linseed mash prepared in a lumpy condition generated hydrocyanic acid from these lumps, slowly at first, but rapidly when the lumps were broken up, showing that the enzyme had not been destroyed in the comparatively dry material inside the lumps.

The extractives, such as petrol, ether, chloroform, etc., had no marked effect on the enzyme, so that the removal of oil from the seed in the manufacture of linseed cake by the solvent method, far from producing a safer material, only tends to concentrate both enzyme and glucoside.

544 - **Live Stock in Morocco.** — MONOD, T. in *Revue générale des Sciences pures et appliquées*, Year 25, No. 7, pp. 341-346. Paris, April 15, 1914.

Though Morocco is a country eminently adapted to agriculture and live stock, its production has remained at a low level owing to the defective methods practised by the natives, who make no attempts to save their stock in years of drought. Conditions could be considerably improved by 1) creating food reserves to fall back upon in periods of drought, such as hay, forage crops, irrigated meadows or maize and sorghumilage, and

(1) See No. 1352, B. Dec. 1913.

(E2)

2) tapping springs and building stone drinking troughs to improve the hygienic condition of the present water holes, which are a constant source of disease to stock.

Horses.— The type varies with the soil in the different localities but all are preeminently saddle horses and belong to the Berber type. They are quiet, hardy, mettlesome, but are lacking in breed and shapeliness. Usually they are less well cared for than in Algeria, brood mares being ill fed and generally undersized. Where they receive rather better treatment, such as in the Marrakech district, the superiority of the animals is evident. The introduction of Arab thoroughbreds should prove very beneficial and the work undertaken in this direction by the State studs should give excellent results.

Mules are very popular in Morocco both for agricultural purposes and as carriage or saddle beasts; they fetch a good price (£24 to £64) and their improvement by means of selection and the use of imported asses should prove remunerative.

Cattle.— A large demand and a low production due to droughts and diseases have combined to raise prices abnormally, *i. e.* to twice their value of two years ago. Numerous breeds exist, all hardy and fattening readily when well fed. Cattle receive no kind of care; they are allowed to breed promiscuously and are kept out without any kind of shelter. Yet it should be possible to obtain both a good milking breed and a good working breed from the native animals.

Sheep. — Sheep number 1 500 000 in Western Morocco and 900 000 in Eastern Morocco in those districts under French influence, and would be liable to vast improvement under a judicious system of breeding and selection.

Pigs belong to the Iberian race and are spreading all over the country as the natives have not the same antipathy for that species of animals as have the Algerians. A good export trade to Europe, where the products find a ready market, may be predicted.

545 — **Live Stock in New Caledonia.** — LAFFORGUE, G. in *La Vie agricole et rurale*, Year 8, No. 7, pp. 175-177. Paris, January 17, 1914.

New Caledonia is situated on the southern limit of the tropical zone and has a remarkably constant climate, with a mean temperature of 68° to 77° F. (minimum 57° F. and maximum 97° F.), rather long droughts and occasionally very wet periods. The soil is only moderately fertile and may be put under coffee, but live stock rearing is the chief resource of the country.

Colonists embarked on cattle rearing from the outset, using as basis animals of the Shorthorn, Hereford, Devon and Aberdeen-Angus breeds. Crosses of Shorthorn-Devons or Shorthorn-Herefords are now commonest, and of these two, the former seems the better adapted to the country. Large herds, up to 1000 head, range freely on the open stations, which may cover an area of 15 000 acres each, in charge of mounted stockmen who are ably seconded by their dogs. Males and females are never separated and breed promiscuously.

An extensive bibliography is appended to the publication, which, in its present (second) edition, forms the starting point for the half-yearly Review (*Revue semestrielle du mouvement international des engrais chimiques*). The publication of this Review was decided upon at the last General Assembly of the Institute (Inst. Int. d'Agr., 4^{ème} Ass. gén., Décis. II, Rapp. Pioda-Laur, 1913) and the first number will appear on September 1, 1914.

606 — **Five Years' Manuring Experiments in East Prussia.** — STUTZER, A. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 258, 236 pp. Berlin, 1914.

The writer, with his collaborators, carried out in the five years 1909 to 1913, 66 field manuring experiments on 15 different estates, and 17 trials of manures for meadows and pastures on several farms. The most important results obtained are the following.

1. *Potash.* — According to the literature on the subject, potash manures are credited with protecting winter cereals and other plants against frost, and this when the potash manures have been spread before sowing and the plants have taken up and elaborated the potash. According to the writer, it is very probable that the effect of potash manures in this direction depends rather upon certain accessory circumstances than upon the plant-food potash itself.

In the experiments, the 40 per cent. potash salt proved better than kainit as a winter top-dressing.

In sowing clover under spring grain (oats or barley), manuring with potash should not be neglected, as it is important for the cereal and still more so for the succeeding clover. In manuring experiments on permanent pastures and meadows, potash manures have proved especially necessary.

2. *Nitrogen.* — The experiments have confirmed the observation that dunged manure which received nitrate of soda as well as potash and phosphoric acid made much better use of the potash in the manure and in the soil, and also of the nitrogen in the farmyard manure.

Further experience has been gained as to the good effects of the nitrogen in nitrate of lime.

The effect of cyanamide in these experiments was considerably inferior to that of nitrate of soda or of nitrate of lime. The troublesome dust produced by cyanamide when broadcasted could be avoided by mixing with it 10 to 15 per cent. of iron pan. This also improves its action, as the presence of iron oxide assists in the transformation of cyanamide into urea. This mixture as a top-dressing for winter grain gave an increase in the yield and a better utilization of the nitrogen, viz. from 48 to 62, 29 to 59, 37 to 78, 49 to 87, 42 to 57 and 46 to 64 (as percentages) in the various experiments.

Cyanamide freed from carbide by treatment with steam gave a higher yield of grain than ordinary cyanamide in field trials with oats. The same result was obtained by adding organic substances to cyanamide.

Sulphate of ammonia obtained by Haber's process (combination of atmospheric nitrogen with hydrogen to form ammonia) proved equal in field trials to the product of coke and gas works.

exclusively by cooperative breeding and economic associations. Up to the present 3500 cows on 692 farms have been tested.

Moravia has, at present, two testing associations with 50 members and 320 cows.

In Upper Austria the Simmentaler Cattle-breeders' Federation at Schärding has kept milk records since 1904. Since 1912, 96 breeders with 888 cows have submitted to the control. From 1904 to 1912 the average milk yield rose by about 44 gallons per head per annum. In 1910 the Federation of Simmentaler Breeders at Ried began the work of milk recording, and the next year the Montavon breeders followed suit. In the latter federation, 191 members with 2879 cows submit to the control.

In Salzburg, for the last two or three years six cooperative breeding associations with 1675 cows have been keeping milk records.

Extensive test milking is practised in the Tyrol also, but on account of the communes and farms being so widely scattered in the high mountains, a good deal is left to the private recording of the farmers.

In Styria, the "First Styrian Milk Control Association" has carried out regular milking tests since 1904. In that year it numbered 11 members with 365 cows, while in 1914 there were 30 members and 1050 cows. The contributions for large landowners are 16s 8d per year and 2s 6d per cow per year, while peasant owners pay only 10d per year per cow. The association has a yearly State subvention, which has grown gradually from £33 4s to £125. The tests are made three times a week, three persons being employed for the purpose.

Besides the above, milking tests have been practised in Styria by the Federation of Murbodner Cattle-breeding Cooperative Associations since 1910. At present 1632 cows are under control.

548 - **Red Flemish Cattle.** — RAQUET, H. in *Annales de Gembloux*, Year XXIV, No. 2, pp. 81-102, Brussels, February 1, 1914.

The total number of Flemish cattle is estimated at 700 000 head in France and 500 000 head in Belgium. In Flanders in 1912, their density was about 1 to 2 $\frac{1}{2}$ acres. As milkers they are almost equal to the Dutch breed when under a favourable system of management: 14 cows on the farm of Mr. Talpe of Hooghlede, West Flanders produced during the seven years 1902-1908 an average annual yield varying from 780 to 1080 gallons with the nature of the season, being highest in the wetter seasons.

At agricultural shows in Belgian Flanders, points are awarded according to the following scale:

Cows.		
General appearance, frame	20	} general conformation 50 points
Dorsal line	10	
Head, horns, breed characteristics, coat colour	10	
Skin	10	
Udder and teats	20	} milking qualities 50 points
Milk veins,	20	
Escutcheon	10	
	100	

Bulls.

Dorsal line	20
Frame	20
Fore quarters	20
Skin, horns	10
Pedigree, milking characteristics, escutcheon	10

100

The breed is very adaptable and has been substituted for Swiss and Dutch cattle in the province of Santander (Spain). It has successfully established itself in Argentine, but the Argentine strain, which is the result of crossing the old red-and-white Flemish cattle with Shorthorns, is more like the old Zeeland cattle than the modern Flemish breed. The breed, represented by 52 bulls and 11 heifers from the best Flemish herds, has also been imported into São Paulo, Brazil.

The French herd-book was started in 1886 at Bergues, while the Flemish one is of more recent origin and has its headquarters at Roulers in West Flanders. The writer considers that for registration purposes, the breed should be divided into three sections: 1) milking type, red with a black nose, the original type; 2) beef type produced by crossing with the Shorthorns, red with a pink nose; and 3) general purpose type with predominant milking qualities, red and white with a pink nose. He further suggests that the fee for entering should be abolished as an encouragement to breeders.

549 - **Determination of Growth in Grazing Cattle.** — BRUCHHOLZ, K. G. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 16, pp. 185-187. Hanover, April 17, 1914.

The writer divides young cattle into three groups according to the nature of the growth they make while at grass: 1) Those which form chiefly bones and flesh: these eventually grow to big beasts, and when still young give promise of becoming good breeding, milking or fattening stock. 2) Those in which the increase of weight is almost entirely due to fat: they always remain small, and are less valuable than those of the first group. 3) Those which make little increase in fat, bones or flesh: they will always be poor animals.

To find out to which category the young stock at grass belong, it is essential to take body measurements as well as noting the increase in weight. The writer recommends taking only the girth measurement, at the beginning and end of the grazing time, as taking detailed measurements of a large number of animals is very laborious. The value of this method is shown by the accompanying table, in which data are given for eight heifers; these were turned out to grass in May, at eighteen months old, and taken off again in October. Four months after dropping the second calf they were weighed again for comparison with the data obtained earlier.

It may be noted that the chief increase of live-weight took place in May and June; four of the heifers showed much less increase in July and August, and three of them a decrease in September. The girth increased much more evenly.

Increase in weight and girth of heifers.

Number of heifer	1	2	3	4	5	6	7	8
Increase in live-weight during grazing period. . lbs.	216	249	129	64	115	164	293	140
Increase in girth during grazing period in.	12	10	9 $\frac{1}{2}$	8	7 $\frac{1}{4}$	3 $\frac{1}{2}$	2 $\frac{1}{2}$	1 $\frac{1}{4}$
Live-weight 4 months after second calving. . . lbs.	1 456	1 318	1 397	1 273	1 278	1 154	1 067	1 005

The table shows clearly that the heifers which increased most in girth were the ones which eventually made the heaviest cows, while the increase of live-weight at this period shows no correlation with the live-weight of the mature animals.

550 - **Heredity of Twin Births in Cattle.** — UHLMANN, E. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 14, pp. 163-164. Hanover, April 3, 1914.

The writer has investigated a herd in which the birth of twin calves has been very frequent. He found two sisters which had borne twins 2 out of 7 and 4 out of 9 times; the dam of these cows (as well as the two other sisters) never had twins, but the maternal grand-dam once gave birth to twins. Two daughters of the first cow have also given twins (each 1 out of 3 times), while two daughters of the second cow have calved two and four times respectively without producing twins.

The bulls used have been of various strains not known to have a tendency to twin-production.

The evidence seems to point to a twin-producing character being inherited from the grand-dam mentioned.

SHEEP

551 - **Marocco Sheep and their Products.** — *Bulletin économique du Maroc*, Year I, No. 6, pp. 5-7. Rabat, August 15, 1913.

There are two chief breeds of sheep in Morocco.

1. The *Muluya Basin* breed, found in the high plateaux of Eastern Morocco, has a close fleece very similar to the Merino; it is hardy and resistant to drought.

2. The *Atlantic* or *Western* breed which is a kind of degenerate merino.

These types vary to a certain extent; in the neighbourhood of Tangiers, some imported Spanish Merinos have improved the local sheep, while in the neighbourhood of Fez two modifications are met with: the *Beni-Hassen* with a long silky fleece, and the *Berber* which is smaller with a heavier, coarser fleece.

The principal sheep-breeding centres are the High Plateaux of Eastern Morocco and the fertile plains of the Atlantic coast, the Rharb district, the district of Beni Hassen, parts of Shawia, and above all the Marakesh district, the annual production being approximately as follows:

Rabat district	100 000
Fez and Sifru district	50 000 to 60 000
Meknes district	20 000 » 25 000
Shawia	50 000 » 60 000
Mazagan and Saffi districts	300 000

In the Rabat district, prices range from 12s to 17s per head. Exports by sea are prohibited; sheep may leave the country by way of Algeria (approximately 200 000 per annum are exported), and are taxed 3*d* per head on passing out at the frontier. Shearing is carried out in spring and the natives take the fleeces to Jewish or European dealers the following winter and receive 1s 4*d* to 2s per fleece. The wool is graded into three qualities:

1. *Ourdigha* — short and fine, comes from Shawia and Tadla and fetches the highest price.
2. *Aboudia* — medium quality and unwashed, comes from the Rharb district and the Sebu Valley.
3. *Beldia* — low quality, comes from Rabat, Saffi, and Mazagan districts.

Exports are taxed 4*d* a lb. on washed wool and 6 ½*d* a lb. on unwashed wool, the washing having caused the wool to loose 50 to 60 per cent. by weight. Formerly France was the only importing country, but now Germany takes a large part of the wool produced, as is shown by the following table:

Importing country	Value of imported Moroccan wool			
	1909	1910	1911	1912
	£	£	£	£
France	74 250	91 600	106 800	32 740
England	6 000	13 060	5 250	4 290
Germany	26 990	69 630	90 240	32 580

Large quantities of skins are exported. Sheep skins are also largely turned into slippers, which are then exported to Algeria and Egypt.

552 — **Development and Prospects of Sheep Breeding for Wool in German South-West Africa.** (Lecture given by Prof. GOLF at the meeting of the Kolonial Wirtschaftliches Komitee) in *Zeitschrift für Schafszucht*, Part 4, pp. 81-86. Hanover, April 1914.

The breeding of sheep for their wool is destined to become the most important branch of farming for at least one half of the total area of German South-west Africa. The most important area is the whole south of the colony, that is all the country south of a line running eastward from Windhuk. Then in the northern half of the colony there is a western dry part which is bounded on the west by the Namib desert and on the east by a line drawn from Windhuk to the Kunene passing through Wal-daw, Omaruru and Franzfontein. To the north and east of this district cattle are more suitable than sheep, as the thorny pastures injure the fleeces.

On April 1, 1912, the number of wool sheep in German South-west Africa was 46 901. The yield of wool is inferior to that of South Africa, which

is 8.8 lbs. of unwashed wool per head; in 1910 the export from German South-west Africa was 186 180 lbs. worth £37 401. If this industry is to develop satisfactorily, the breeding and management must be improved with the introduction of special wool-producing breeds, the aim being the production of wool of the best quality.

As the most suitable sheep the writer recommends Cape Merinos, which might be improved by the introduction of pedigree rams. In the North of the colony the German Tuchwollschaf would probably be suitable for crossing; in the south, however, the German, Australian or African Kammwollschaf would be more advisable for the present.

GOATS

553 - **Present State of Milk Recording for Goats in the German Empire.** — Report made in the autumn of 1913 to the German Agricultural Society, subcommission for milk records for goats, by Dr. MÜLLER of Dortmund; in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 29, Part 9, pp. 138-140. Berlin, February 28, 1914.

The German Agricultural Association (D.L.G.), in the summer of 1912, addressed an enquiry to all the central agricultural offices (*landwirtschaftliche Zentralstellen*) on the present situation and development of milk recording for goats, and received the following information.

Milk records are kept at present in the Grand Duchy of Hesse, in Hesse-Nassau (district of Wiesbaden), in the province of Saxony, in the Rhine province, in Westphalia, Hanover, Brunswick, Coburg and Sachsen-Altenburg, and in the Kingdoms of Württemberg and Saxony. In several localities, as in Silesia, Oldenburg, Baden, Bavaria and Lippe, the record of performances has been begun, but up to the present there are no complete yearly records available. The milking tests, which yield more or less useful figures, are about 500, and refer to the most different breeds of goats. The first tests appear to have been made in the Grand Duchy of Hesse and in the Kingdom of Saxony about the end of the last century. Recently, thanks to the increasing recognition of the importance of milk recording work, it has been receiving considerable financial aid from the numerous agricultural central offices. Special instructions on the method of carrying out these milking tests are at present published only in Württemberg and Hanover, though short directions are to be found almost everywhere.

The best results have been obtained in those localities in which a special control assistant was available (Westphalia), or in those in which some organization took an interest in milk control.

Most of the observations, especially of late years, are no longer made by measure, but by weight, and if possible every fortnight. In only a few localities are records kept of the weight, age and mating of the animals and of the number and weight of the kids dropped. Data on the height and girth, and on the feeding and utilization of the food, are nowhere to be found. On the other hand in some places the net returns have been calculated. The results vary between — 5s 9d and + £7 10 s per animal per year.

The results hitherto obtained are insufficient for the clearing up of several questions connected with the keeping of goats, to a great extent

because they have been obtained by different methods. It is therefore highly desirable that in future uniform methods be adopted.

554 - **The Olfactory Sense of the Honey Bee.** — MC INDoo, N. E. (Bureau of Entomology, U. S. Dep. of Agriculture, Washington, D. C.) in *The Journal of Experimental Zoology*, Vol. XVI, No. 3, pp. 265-345. Philadelphia, Pa., April 5, 1914.

Olfactory pores were found on the bases of the wings, and on the trochanter, legs, and sting. They numbered approximately 2600 in the drones, 2200 in the workers, and 1800 in the queen. They are described in detail.

555 - **Silkworm Rearing in Madagascar** (1). — I. FAUCHÈRE, A. in *L'Agriculture Pratique des Pays Chauds*, Year 14, Nos. 130-132, pp. 12-23, 92-102, 140-147. Paris, January to March, 1914. — 2. *Journal d'Agriculture Tropicale*, Year 14, No., 153, pp. 89-91. Paris, March 31, 1914.

BEES

A full account is given of the treatment of silkworms in Madagascar; the Centre is the most favourable part for *Bombyx mori*, called "landikely".

The native worm is *Borocera madagascariensis*, known as "landibe"; this is reared in the open, either in natural forests of "tapia" (*Uapaca clusiacea*) in the Centre and "afiafy" on the coasts, or in plantations of "tsitovina" (*Dodonea madagascariensis*) and *Cajanus indicus*. There are two broods in the season; the cocoons are grey and cannot be reeled: they are therefore carded and spun. This silk gives rise to a considerable trade in the island.

556 - **Silkworm Rearing in the Yalong Valley, China.** — LEGENDRE, A. F., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, Vol. XIII, Parts I-III. Montpellier, July and October 1913, and January 1914.

SILKWORMS

The rearing of silkworms in China has been very little improved since early times, and it would probably be possible to double the yield at very little expense. The writer has studied silkworm rearing at a village near the Yalong river in Szechuan; it varies little throughout the Empire, unless subject to European influence, as at Canton and Shanghai.

In spite of the height (6000 to 7000 ft.), the eggs begin to hatch at the end of February or in early March; hatching is sometimes hastened by keeping the eggs in a warm room; it lasts three or four days.

Little attention is given to the worms; they are kept on heaps of leaves of mulberry (*Morus alba*) or "ta tchou" (*Cudrania triloba*), in baskets or on coarse bamboo mats; these are kept in the roof, and often above the kitchen, as the smoke from the green firewood is supposed to keep away insects.

The worms of the Kienchang district (Szechuan) moult three times: each stage lasts about 13 days, and spinning up takes another 10 days, so that the whole rearing period is 49 days. For the first two stages only *Cudrania* leaves are used; they are fed cut up small in the first stage, in large pieces or whole in the second. The leaves are picked once a day, as soon as the dew is off, and the number of meals is increased from four to

(1) See No. 967, B. Aug. 1913.

eight as the worms grow; in rainy weather they are not fed. It is supposed that leaves covered by the fine sand occasionally brought by the wind are fatal. The old leaves are not removed till there is a considerable accumulation of them, when the worms are picked off into baskets and then put back onto the fresh leaves.

The chief errors in the Chinese method are crowding together of the worms and not cleaning out often enough; for these reasons the worms are liable to disease. The only remedy known is to pick out the diseased ones, which can be done only imperfectly owing to the size of the mats.

For spinning up, dry rape stalks or oak twigs with the dead leaves on are used. Seven days after the cocoons are finished they are placed in the sun to kill the larvae, or in dull weather they are put in an oven.

The moths emerge from the cocoons kept for egg production 12 to 15 days after the beginning of spinning; a number of females are made to lay on each of the egg papers used: these measure about 17 by 11 inches.

Cocoons. — The cocoons are divided into six groups according to shape and quality. In a normal rearing there are 15 to 20 per cent. of the first quality and 35 to 40 per cent. of the next two, some 35 per cent. being inferior and 10 per cent. double.

About 33 fresh or 43 dry cocoons go to a Chinese ounce (37 gms.). The yield of raw silk does not exceed 9 per cent. of the weight of the fresh cocoons and $7\frac{1}{2}$ per cent. is a good average; in bad years it may be only 4 to $4\frac{1}{2}$ per cent.

The cocoons are of four chief colours: pure white, canary yellow, golden and green. The raw silk is dull and dirty-looking.

The yield from 25 gms. of eggs may be 23 kg. in a good year, and is 18 kg. in ordinary seasons, while in France 60 kg. is often obtained.

Breeds. — Four breeds are known, all being single-brooded and with eggs in clusters:

1. *Pé-ts'an* (uncoloured); two varieties, one with white legs (giving white cocoons) and the other with yellow legs.
2. *Houa ts'an* (speckled); each segment with a grey band posteriorly; legs yellow.
3. *Lao hou ts'an* (striped green); uniform dark brown, with pale yellow velvety legs; head striped with black; cocoon very full, but often green and therefore not liked.
4. *Ou ts'an*; less dark than the preceding, with the same striped head; prolegs yellow.

There is also a wild silkworm ("ié ts'an"), much like the "lao hou ts'an", living on mulberry.

Diseases. — "Pébrine" occurs occasionally in a mild form, and is supposed never to occur with "flacherie"; the latter breaks out every three or four years and carries off 90 per cent. of the worms. "Musccardine" takes about 1 per cent. of the worms, and "grasserie" (which prevents their spinning) about 10 per cent. A good many of the worms pupate without spinning.

Bajac's three-furrow Flemish plough with counterweight.

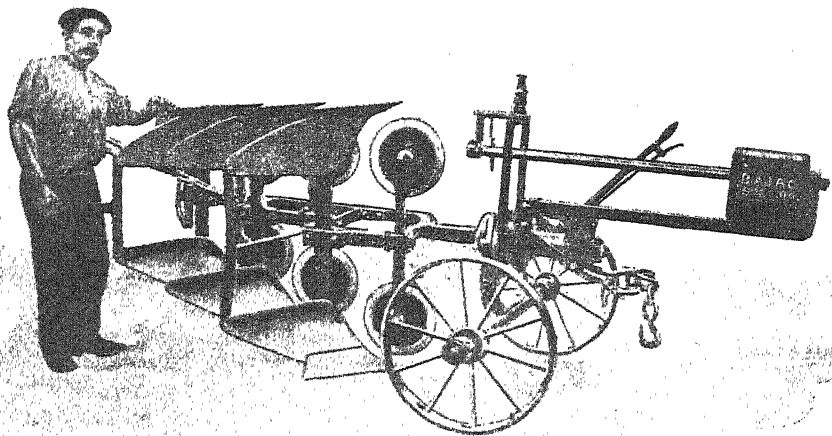


Fig. 1.
Position for turning.

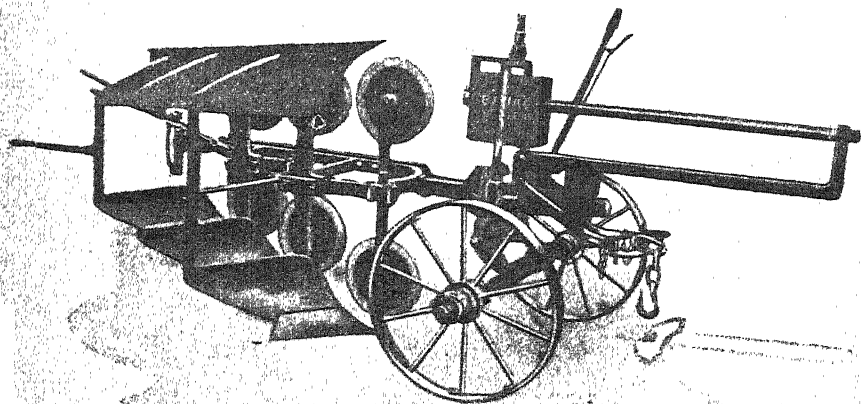


Fig. 2.
Position for working.

One of the worst enemies is a fly, which oviposits in the larvae; its spread is encouraged by the practice of leaving the dead worms about instead of burning them.

Mulberries.—There are four varieties: *a*) with dentate leaves; *b*) with deeply divided leaves, not so well liked by the worms; *c*) with leaves pubescent along the veins, and *d*) the wild mulberry with pubescent leaves refused by the domestic silkworms. A trunk-rot is about the only disease seen.

FARM ENGINEERING.

557 - **Machines at the General Agricultural Show, Paris, 1914.** — RINGELMANN, MAX in *Journal d'Agriculture Pratique*, Year 78, Vol. I, Nos. 11, 12, 13, 14, pp. 341-344, 371-373, 399-402, 438-439. Paris, March 12, 19, 26 and April 2, 1914.

This year the number of exhibitors was 619 as against 665 in 1913. The importance of the show, however, was not lessened and bore witness to the constant improvement in the construction of agricultural machines and implements. In this paper detailed descriptions and figures of several of the exhibits are given.

I. *Apparatus for the mechanical tillage of the soil.*—This class was represented by a large number of machines, including almost all those which took part in the Grignon and Trappes trials of last autumn. Among the tractors, windlass and hauling tractors, motor ploughs and rotary diggers, steam lorries and steam and petrol traction engines, the most noteworthy were the exhibits of the following firms: Compagnie internationale des machines agricoles de France, Bajac, G. Filtz, Stock, Bauche, Lefebvre, Doizy, Société de la Motoculture Française, Tourand and Derguesse, Foden, Société française de matériel agricole of Vierzon, Pécard frères, Lanz, de Mesmay, Case Co., Pavesi and Tolotti, Dion-Bouton, Lefébure, Landrin, and Amiot.

In the latest type of the DE MESMAY tractor, all four wheels are driving wheels, the object of this being to diminish the compression of the soil. Its width is only 50 inches so that it can be used in vineyards. It weighs empty about 3080 lbs. One of these machines (15 HP) took part in the international competition at Chassart in September 1913, when, according to the general report, it ploughed 6.92 acres to a depth of 6.3 inches in 15 hours 57 minutes, the work being excellent.

The CASE tractor (40 HP) weighs 7.26 tons when in working order; at Chassart it hauled a 6-furrow gang plough and ploughed 23.34 acres to a depth of 6.5 inches in 16 hours 4 minutes. It worked very regularly, never stopping for more than a few minutes to lubricate.

The LEFÉBURE windlass consists of a four-wheeled chariot bearing a vertical Abeille engine (12-15 or 20-25 HP), which drives a windlass mounted on a horizontal axis at right angles to the axes of the wheels. In ploughing, two of these machines are used as on the usual double-engine system. Each windlass weighs empty 5500 to 5900 lbs.

AGRICULTURAL
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The LANDRIN windlass tractor carries a 45 HP engine and weighs about 5.4 tons ; it can travel at four different speeds, from 1.86 to 7.45 miles per hour. The driving wheels are provided with twelve adjustable cleats which can project up to 4.8 inches. The motor by itself proceeds rapidly, then stops, anchors itself and hauls in the cable also at four different speeds, from 0.9 to 3.7 miles per hour. It can wind up to 500 feet of cable.

AMROT's motor plough with a 40 HP Abeille engine is mounted on a four-wheeled frame. The driving wheels are provided with oblique projecting cleats which are removed when travelling on roads. The plough is situated behind the motor ; it is a double three-furrow Flemish gang plough, which can be lifted by a kind of crane worked by the motor itself ; thus one man can drive and work the whole machine from his seat.

PAVESI AND TOLOTTI's motor plough consists of a triangular frame on three wheels, the front one being the steering wheel and the near hind one the driving wheel. The latter is provided with blades which project vertically from the lower part of the tire only, and are worked by a special excentric. The ploughs, from one to six in number, are placed at the side of the frame between the steering and driving wheels, so that the plough beam is pushed instead of being hauled. One man seated about the middle of the frame is sufficient to drive the machine. It is built in two sizes, 16 to 20 HP and 40 to 50 HP.

Among the ploughs exhibited in Paris, an improvement deserves to be specially mentioned, *viz.* A. BAJAC's movable equilibrium counterweight. As is well known, it is extremely fatiguing for the ploughman, when using the heavy two or three-furrow double Flemish ploughs, to turn them round at the end of the furrow, or to move them on a road or headland. In order to obviate this drawback BAJAC fit a sliding cast iron weight (176 lbs.) on to a horizontal hollow bar attached to the fore part of the plough (see figs. 1 and 2). The weight can be retained at the extremity of the bar by means of a pin. When the weight is behind the axle of the fore-carriage it increases the weight of the plough and presses it into the ground, while, when pushed to the extreme end of the bar, it counterbalances the weight of the plough and allows the latter to be easily handled. This principle has been applied by BAJAC in several different forms ; in the case of the largest ploughs the counterweight and fittings weigh as much as 440 lbs. and the weight is shifted by a small winch.

Sowing machines and drills.— Of the numerous drills, that exhibited by O. JOERISSEN is a force feed with an obliquely fluted feed shell, varying in size according to the nature of the seed. The quantity drilled is regulated by the speed of the feeding shaft ; the gearing is enclosed in a casing and may be adapted to 16 different speeds.

In the « Baby » drill the fluting is double and parallel to the axle.

In LAVAULT's drills the feed consists of a series of claws acting alternately and varying in size according to the nature of the seed.

In CHARLIER FRÈRES's drills the shoe furrow openers are replaced by two disks set at an acute angle to each other.

Potato planters are represented by the MOLINE machines and by those of FASCIAUX; in the latter a boy seated on the planter throws the seed potatoes into holes made in the ground by blades mounted on a disk revolving at right angles to the axle of the wheels; by changing the gears the holes in the rows may be made at 18, 20 or 22 in. apart.

Sprayers and sulphurers. — Various models were exhibited by a number of makers, among whom V. VERMOREL showed a very complete collection.

BERGÈS BACHASSE AND Co. showed a pack-saddle sprayer in which the two cylindrical reservoirs are fitted with a device to diminish or prevent the wave motion of the liquid in them which is so trying to the animal. It consists of a series of slotted felt disks arranged parallel to the ends of the reservoirs.

MIRANDE FRÈRES' sprayer is mounted on two wheels; equilibrium is maintained by special harness and the whole can pass between rows of vines only 3 ft. 3 in. apart.

Harvesting machines. — S. PLISSONNIER exhibited a motor mower on Valloton's system; it is on three wheels with a 6 to 8 HP engine; it weighs about 1980 lbs. and cuts 3 ft 3 in. to 6 ft 6 in. according to the kind of crop and the slope of the field.

The SOCIÉTÉ LA FRANCE exhibited a motor reaper and binder. It carries a small 3 1/2 HP engine which drives the reaping and binding apparatus, while the team only draws the machine. Somewhat similar machines are shown also by some American firms, in which the engine is partly supported by a small wheel.

GARNIER AND Co. exhibit a horse rake with several improvements, among which is one to deaden the shock of the teeth.

Among the reapers and binders A. RIVET presented one in which the reel slats instead of being placed in planes parallel to their axis of rotation are disposed helically so as to throw the grain obliquely on the platform canvas; the binding is improved by this means, especially in the case of short straw.

G. RICHOMME exhibited a combined binder and thresher which on the whole resembles a common binder, but the elevator is replaced by three successive threshing devices through which the cereal ascends; the straw then passes onto the binder deck and the grain is elevated by a belt and poured into sacks.

There were several POTATO DIGGERS and BEET ROOT LIFTERS, among the latter one built by GUICHARD & FILS provided with an elevator that loads the beets into a cart.

Motors. — A number of internal combustion motors were exhibited, some burning paraffin, others heavy oil, naphthaline and producer gas; among these DUBOIS' two stroke motor is noteworthy for the distribution which is effected, not by valves, but by the displacement of the piston which uncovers alternately the opening for the escape and that for the admission of compressed air into the case.

Machines for the preparation of agricultural produce for market. — Several threshing machines were exhibited, each of them presenting some improved detail. There were fans and straw elevators forming part of, or working with, threshing machines or straw balers. Among the latter LEFEBVRE-ALBARET exhibited a baler which turns out bales weighing 77 to 88 lbs., and which is arranged so as to make small bales also, not exceeding 22 to 33 lbs.; and the COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES DE FRANCE exhibited a portable baler with a rapid stroke of the piston and carrying a 4 HP horizontal engine on its fore-carriage.

G. BARRAULT exhibited a pulp and straw mixer for the thorough mixing of small straw and beet pulp.

SIMON FRÈRES had a motor apple-crusher, being a combination of a small engine and a crusher on the same small chariot.

For wine making there were several labour-saving machines: MABILLE FRÈRES' *foulo-pompe* crushes the grapes and elevates them by means of a screw working in a horizontal cylinder, which, after crushing them, forces them up a vertical or inclined pipe. One of these machines driven by a 3 HP motor could crush and raise to a height of 50 feet from 12 to 15 tons of crushed grapes per hour.

Always with a view to saving manual labour many large hydraulic and motor wine presses have been built and exhibited. In MARMONIER ET MABILLE'S presses the hydraulic pumps are driven continuously by a motor and a special device prevents the pressure exceeding a certain fixed limit.

In MARMONIER'S vertical pump a rapid displacement of 2.4 to 2.8 in. per minute can be obtained at first, which grows slower as the pressure increases. In MABILLE'S pump the pressure automatically rises again as soon as it has sunk owing to the flow of a certain quantity of must.

Other machines and implements. — Among pumps one exhibited by C. DUQUENNE for deep wells or borings is distinguished by a descending column of water under pressure playing the part of piston to an apparatus situated at the bottom of the well called an aspirator. GIGON exhibited an apparatus, connected with a small clock, which, on being set, will automatically discharge into a manger a previously prepared ration of fodder when the given hour is reached.

558 — Motor Ploughing Competition of the North Kent Agricultural Association.

— *The Implement and Machinery Review*, Vol. XXXIX, No. 464, pp. 1089-1092. London, December 1, 1913.

On November 5, 1913, a motor ploughing competition was held by the North Kent Agricultural Association at Farningham, at which the following four machines competed, the prize offered being a gold medal;

Saunderson's « Universal » Model G, 18 to 20 H. P. agricultural motor and a Howard 3-furrow B. Z. plough,

The Ideal Agricultural Motors Co's « Ideal » agricultural motor and a Howard 4 furrow plough.

The « Stock » self-contained 6-furrow motor plough.

The « Ivel » old pattern 20 H. P. agricultural motor with a Cockshutt « Kid Kangaroo » 3-furrow plough.

To each machine a portion of land in the same field was allotted. The land was substantially of identical character throughout the four portions. The depth of the ploughing was in all cases approximately 7 inches and the quality of the work was fair. The consumption of fuel after running two hours was measured.

In making their award the judges made the question of first cost and economy of working an important factor. The other points on which the judging was based were: Acreage ploughed in a given time, quality and depth of work, weight on the land, fuel and oil consumption, ease of transport, simplicity of design and strength, accessibility and facility of repair, adaptability to other farm uses and ease of handling. For each point marks were awarded on a variable scale according to its relative importance. Full consideration was also given to interest on capital, depreciation, maintenance and repairs. In the results the points awarded were as follows:

« Universal »	357	« Stock »	276
« Ideal »	294	« Ivel »	158

The following table gives the principal results obtained at the trial:

	« Universal »	« Ideal »	« Stock »	« Ivel »
Price . . .	£ 267	£ 650	£ 1 050	£ 365
Acres ploughed in 2 hours. .	1	1	2 ¼	¾
Fuel consumed . . .	paraffin . . . 44 pints	—	—	36 pints
	petrol . . . 2 "	52 pints	—	5 "
	benzol . . . —	—	68 pints	—
Cost per day	£ 1 18s 0d	£ 2 12s 0d	£ 5 6s 4d	£ 2 0s 8d
Cost per acre.	4s 9d	6s 6d	5s 10d	7s 8d

559 — **New Hand Drills** (1). — VON RÜMKE in *Deutsche Landwirtschaftliche Presse*, Year XXXI, No. 33, p. 409 + 1 fig. Berlin, April 25, 1914.

The writer points out the advantages of two hand drills (for one and two rows) and one machine for sowing single grains in holes, built by him and by H. Leidner.

The advantages of the drills consist in their continuous work, in their easy management and their suitability for all seeds and methods of sowing. They allow a very uniform distribution of seed, even with small quantities per unit of surface; they do not crush or otherwise injure the seed and they can be instantly emptied by tilting over. The two-

(1) See: No. 1207, B. Aug. 1912.

row machine allows of the rows being from $3\frac{1}{4}$ to 16 inches apart and it is so constructed that the seed can flow into only one funnel if so required. The field to be sown does not require any other preparation than that which is usual for team-hauled drills, nor is any harrowing required after drilling.

The marker is especially suitable where grains have to be sown singly. With three or four assistants upwards of 50 000 seeds can be sown per day.

These machines will be found especially useful in plant-breeding establishments, in gardening and forestry, and in scientific institutions where varieties are tested, and in general in all cases in which continuous and perfect seeding is required. The prices of the machines are the following: - One-row drill £5 8s, the two-row drill £7 7s, and the marker or single-grain seeder £9 16s.

560 - **Fletcher and Beeker's Fruit Grader.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 464, p. 1072. London, December 1, 1913.

The grading of fruits by machinery ensures a more rapid and uniform separation than when this work is done by hand, but some machine graders are liable to damage delicate fruit. With this new grader (see fig. 3, facing p. 808), however, bruising seems to be impossible. Apples, tomatoes, gooseberries and similar fruit can be separated into four grades at the rate of two bushels a minute and cleaned at the same time.

Each grading surface is composed of indiarubber belting, in which suitable sized holes are punched, laced round two rollers, and three such units at varying heights form the bottom of the main trough of the machine. Any of these belts can be quickly removed and replaced by others having smaller or larger holes. The rollers carrying the belts are driven by chain and sprocket gearing actuated by the operator, who stands at the hopper end of the machine.

The fruit as it is carried along by each belt comes into contact with suspended cleaning brushes, which also help the separation, the smallest size falling upon the first packing table and the largest passing out at the far end of the machine.

The packing tables are made of canvas and held in strong wooden framing; their height may be easily regulated.

561 - **"Germania" Potato Esiccator with Oil Heating.** — *Maschinen-Zeitung*, Year 12, No. 4, p. 45. Berlin, February 15, 1914.

The Association of German Potato Dryers recently tested the two-cylinder potato esiccator "Germania" at the potato flake factory at Löbnitz near Cöthen. According to Prof. Parow's report, the trial was very satisfactory.

The special character of this esiccator is that the cylinders are not heated by steam but by oil at a temperature of 250°C . (482°F .), heated in a special boiler, and then pumped into the cylinders. The work is quite free from danger, as the ignition point of the oil is 340°C . (734°F .) and neither the boiler nor the pipes have to bear any pressure. The return of the oil to the boiler is also very simple.

The whole plant, without woodwork and masonry, costs about £800. About £40 worth of oil is required.

562 - The Manufacture of Agricultural Machines and Implements in Russia in 1911. — *Landwirtschaftliche Maschinen u. Geräte*, Year 14, No. 13, pp. 15-22 and 40. Artern, Prov. of Saxony, March 28, 1914.

In 1912 the statistical division of the Bureau for Agricultural Machinery at St. Petersburg, considering it necessary to know the present state of the manufacture of agricultural machines and implements in Russia, collected material by enquiries addressed to manufacturers, to factory and Inland Revenue inspectors, to the Customs Department and to others, and has now published a book on the subject under the title: "The manufacture of agricultural machines and implements in 1911 and their importation into Russia."

In spite of the great competition of foreign countries, the machine industry has developed of late years to such an extent that in 1911 it was in a position to place on the home market £6 502 400 worth of machines and implements, the output of factories, small workshops and private artisans being included in this sum. According to the enquiry, about 820 factories build agricultural machinery; of these 665 are situated in European Russia, 110 in Poland, 37 in the Caucasus and 8 in Siberia. Their total output amounted in 1911 to £5 320 017. Table I shows the number of factories and the value of the machines built by them.

From this table it will be seen that the agricultural machine industry is most developed in South Russia, in the so-called New Russia and in the Northern regions. This is due, on the one hand, to the facilities for providing the raw material, iron and steel, and on the other to the demand for improved equipment in those districts.

The above sum of £5320 017 is distributed among the various groups of machines as follows:

TABLE II.

	£
Tillage implements	954 530
Sowing machines	804 500
Harvesting machines	1 312 321
Threshing machines	713 360
Cleaning and grading machines	239 796
Machines for preparing fodder	146 225
Gins and transmissions	298 053
Power motors	324 062
Other machines and implements and duplicate parts	527 170

£5 320 017

Among the tillage implements, ploughs represent, about three-fourths of the total value. They are built in almost every "government", but especially in Southern Russia, where they were already manufactured on a large scale in the seventies of last century. The total number of ploughs built in Russia in 1911 may be set down at 650 000. The exact number and value of machines and implements constructed by private artisans

TABLE I.

Territories and "governments"	Number of works	Value of output £
<i>Central agricultural territory:</i> Kursk, Orel, Rjasan, Tambov, Tula, Voronesh	73	341 825
<i>Middle Volga:</i> Saratov, Simbirsk, Pensa, Nijni-Novgorod, Kasan, Ufa	63	169 168
<i>Lower Volga:</i> Samara, Orenburg, Astrakhan	9	19 243
<i>New Russia:</i> Bessarabia, Kherson, Taurida, Yekaterinoslav, Don province	157	2 876 913
<i>South west:</i> Kiev, Podolia, Volhynia	68	170 860
<i>Little Russia:</i> Kharkov, Poltava, Chernigov	40	436 242
<i>Industrial district:</i> Vladimir, Moscow, Kaluga, Tver, Yaroslavl, Kostroma	48	328 715
<i>White Russia:</i> Minsk, Moghilev, Vitebsk, Smolensk	47	47 050
<i>Lithuania:</i> Vilna, Kovno, Grodno	11	48 953
<i>Lake district:</i> Pskov, St Petersburg, Novgorod, Olenets	9	10 573
<i>Baltic provinces:</i> Livonia, Courland, Esthonia	39	286 634
<i>Urals:</i> Vyatka, Perm	100	94 945
<i>North:</i> Vologda, Arkhangelsk	1	—
In 50 governments of European Russia	665	4 831 121
<i>Poland:</i> Warsaw, Kalisz, Kielce, Lomza, Lublin, Pietrkow, Plock, Radom, Siedlce, Suwalki	110	437 088
<i>Caucasus:</i> Kuban, Stavropol, Terek, Tiflis, Eriwan	37	43 455
<i>Siberia:</i> Tobolsk, Tomsk, Amur prov., Lake district	8	8 353
The whole of Russia	820	5 320 017

cannot be easily determined; still, from enquiries made, their value may be estimated at about £740 000. Besides this, a number of factories

and workshops mount and repair agricultural machines, for, which they also make a certain number of duplicate parts. The value of this kind of work may be estimated at about £444 066.

The grand total of the output of the Russian factories and workshops is therefore about £6 502 400. But this is insufficient to meet the demands of the Russian farmers, who still import large quantities of agricultural machinery from abroad. According to the Customs returns in 1911 about £6 119 124 worth of foreign machines and implements were imported and in 1912 about £6 540 881. Among the imports of 1911, reapers, hay tedders and horse rakes figure for £2 524 621, threshing machines for £610 907 and scythes, sickles and forks for £264 325.

The consumption of agricultural machines has risen during the last 30 to 35 years from £845 840 to £12 581 870. In order to promote still further the use of good agricultural machines and implements, about two years ago the Russian Ministry of Agriculture set aside an area of 294 acres, near the agricultural school of Eugenfeld, for the establishment of a permanent station for testing such machines. They are selected for trial by a special Bureau in St. Petersburg, which applies directly to foreign firms whose machines it wishes to test and informs them of the condition of the trials. This season most of the tests will deal with tillage machines, tractors, steam ploughs, etc.

563 - **The Trade in Agricultural Machines in France.** — COUPAN, G. in *La Vie Agricole et Rurale*, Year 3, No. 18, p. 469. Paris, April 4, 1914.

There being no available statistics as to the quantities of agricultural machines and implements made in France, an idea of the development of this industry can only be formed from the statistics of the imports and exports. The annexed diagram shows the rapid increase of the imports since 1895 and the slow rise of the exports.

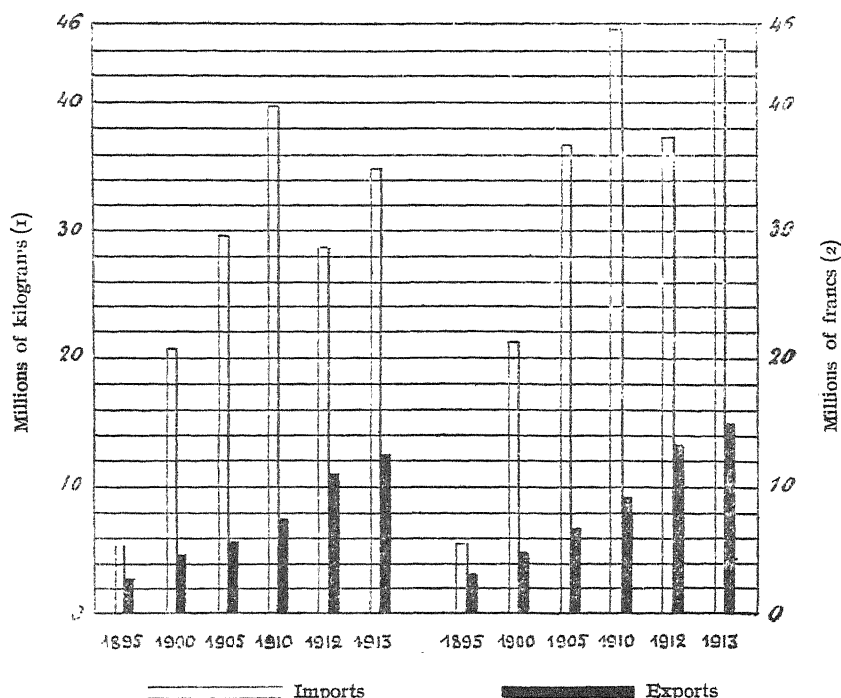
By far the greatest quantity of agricultural machines and implements imported into France come from the United States, namely from 55 per cent. in 1895 to 69 per cent. in 1912. The next most important country in this connection is the United Kingdom (37 per cent. in 1895 to 10 per cent. in 1912) followed by Germany, from 5 per cent. in 1895 to 10.5 per cent. in 1912.) As for the kinds of machine imported, mowers, reapers and binders occupy the first place. During the first 10 months of 1912 and of 1913 they amounted to about 70 per cent. of the total imports.

French machines are exported to many countries, chiefly however to the French colonies and protectorates.

French imports and exports of agricultural implements.

Gross weights.

Values.



(1) 1 million kilos = 2 204 620 lbs.

(2) 1 million francs = £39 648 16s 8d.

564 - Imports and Exports of Agricultural Machines and Implements into and out of Germany in 1913. — *Maschinen-Zeitung*, Year 12, No. 4, p. 42. Berlin, February 15, 1914.

The following table shows the numbers and value of the most important agricultural machines imported into and exported from Germany during the year 1913:

	Imports		Exports	
	No.	Value £	No.	Value £
Threshing machines	526	—	20 189	441 176
Iron ploughs	5 362	—	292 610	653 593
Ploughs for power motors	268	—	326	—
Mowers and reapers	50 638	1 176 468	6 508	—
Milk separators	33 055	133 803	45 892	196 078
Machines for breweries, distilleries, and sugar, lime, clay and cement factories	—	24 510	—	1 862 741
Other agricultural machines	—	133 803	—	1 568 624

565 - Review of Patents

Tillage machines and implements.

- | | |
|-----------------|--|
| Austria, | 64 488. Toothed wheel gear for internal combustion ploughing machine. |
| | 64 489. Spur wheel for steam plough traction engines, motor ploughs and the like. |
| | 64 821. Hoeing apparatus. |
| Belgium, | 262 502. Plough mouldboard with rollers and conveyers. |
| France, | 464 667. One-way plough with metal beam. |
| | 456 191. Motor plough. |
| | 464 058. Motor tractor plough. |
| | 464 232. Attachment for motor ploughs and the like. |
| | 463 000. Double gang plough in which the turning, fixing and adjusting is done automatically by the team. |
| | 463 001. Motor plough. |
| Germany, | 272 006. Apparatus for driving agricultural machines by electric power. |
| | 272 050. Hoe for agricultural motors. |
| | 272 204. Driving wheel for motor ploughs in which skidding is prevented by radially moveable spuds worked by an eccentric. |
| | 272 538. Hoeing machine. |
| | 272 539. Hand tilling implement. |
| | 272 540. Device for simultaneous and uniform raising and lowering of plough shares in motor ploughs with revolving beam. |
| Hungary, | 61 852. Plough drawn by electric power. |
| | 61 947. Tilling machine. |
| | 62 053. Motor ploughing apparatus. |
| | 62 192. Hoeing machine. |
| Italy, | 130 979. Ploughing machine. |
| | 132 899. Improvement in harrows. |
| | 134 585. Improved coulter for ploughs. |
| | 135 964. New non-skidding wheel for ploughing and other agricultural machines. |
| | 137 552. Cultivator. |
| Switzerland, | 63 482. Device for adjusting the gage of plough wheels while working. |
| | 63 484. Tilling implement. |
| | 63 761. Apparatus for machine tilling. |
| | 63 762. Tilling machine with motor driven implement shaft. |
| United Kingdom, | 26 343. Flexible arms for agricultural implements. |
| | 26 500. Ploughs. |
| | 26 593. Cultivating apparatus. |
| United States, | 1 087 620. Motor driven device for tilling the soil. |
| | 1 088 788. Folding harrow. |
| | 1 089 072. Disk furrow opener. |
| | 1 089 325. Soil pulverizer. |
| | 1 089 351. Automatic hoe. |

Manure distributors.

- | | |
|-----------------|---|
| France, | 463 128. Spreading device for manure distributor. |
| Germany, | 272 051. Manure distributor with roller. |
| Hungary, | 62 014. Manure spreader. |
| United Kingdom, | 23 773. Manure and seed drills. |
| United States, | 1 090 293. Fertilizer distributor. |
| | 1 090 356. Fertilizer distributor. |

Drills and sowing machines.

- Austria, 65 008. Furrow opener for drills.
 France, 462 978. Machine for making holes in the ground in which to plant potatoes.
 464 584. Portable sowing apparatus.
 Hungary, 61 803. Potato planting machine.
 61 937. Drill and manure spreader.
 Italy, 136 008. Rotary sowing machine.
 138 540. Apparatus on wheels for thick sowing.
 Switzerland, 63 485. Sowing and manure spreading machine.
 United Kingdom, 25 700. Seed drills.
 United States, 1 087 211. Combined seed planter and manure distributor.
 1 087 319. Seeder and cultivator tooth.
 1 089 458. Corn planter.
 1 089 895. Corn planter attachment.

Reapers, mowers, etc.

- Austria, 64 620. Motor mower.
 France, 463 666. Side delivery rake.
 463 624. Lawn mower.
 463 805. Motor chassis for mowers, reapers and binders of all systems.
 463 398. Mowers with fore-carriage.
 464 451. Improvements in side-delivery rakes.
 Hungary, 61 872. Hand reaper.
 Italy, 134 347. Sheaf opener.
 134 603. Motor mower.
 135 120. Mower, reaper and motor car with reversible motion.
 United States, 1 087 455. Corn harvester.
 1 090 029. Attachment for binders.
 1 090 246. Motor harvester.
 1 090 371. Corn gatherer and husker.
 1 090 747. Tobacco harvester.

Machines for lifting root crops.

- Belgium, 262 745. Improvements in topping and lifting machines for beet and other roots planted in rows.
 France, 463 631. Machine for topping and lifting beets and similar roots.
 463 836. Machine for topping and lifting beets and similar roots.
 464 022. Beetroot lifter.
 Hungary, 61 716. Potato lifting machine.
 61 927. Delivery wheel for potato lifter.
 62 097. Two-rowed beet lifter.
 Italy, 135 987. Potato lifting machine.

Threshing and winnowing machines.

- Belgium, 262 695. Shaker for threshing machine.
 France, 464 634. Sheaf elevator.
 Hungary, 62 130. Cereal cleaner.
 62 248. Grain sieve.
 Italy, 136 041. Threshing and husking machine for wheat and all small seeds.
 Switzerland, 63 487. Apparatus for separating stones and earth from cereals.
 United Kingdom, 26 055. Threshing machines.
 26 433. Separating wild oats from wheat etc.
 United States, 1 087 338. Corn husking machine

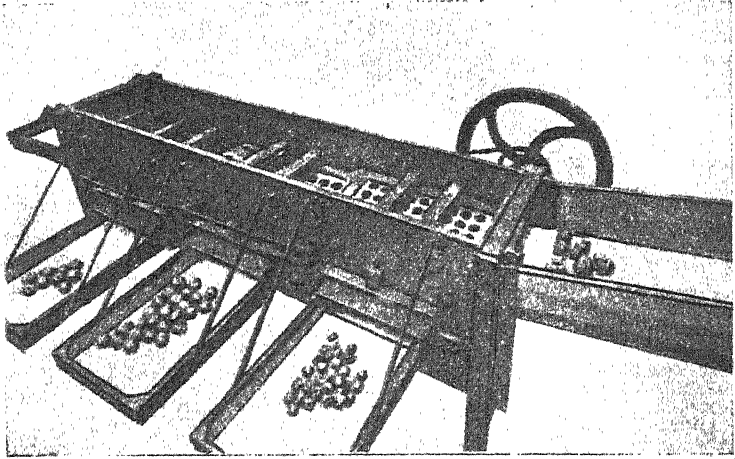


Fig. 3. — Fletcher and Becker's fruit grader (see No. 560).

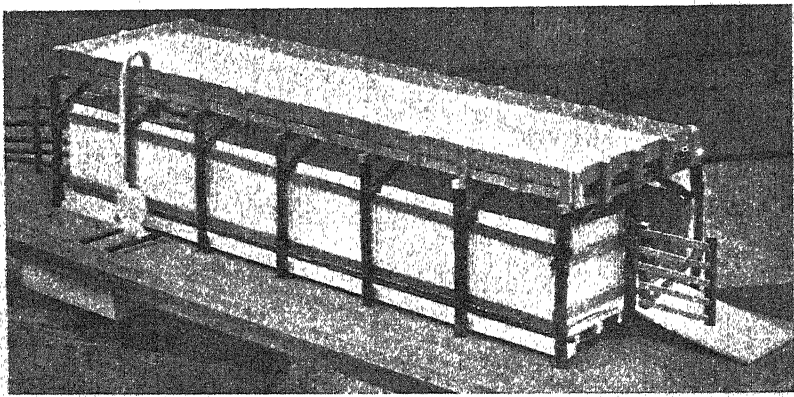


Fig. 4. — Shower-bath sheep dip.

Other agricultural machines and implements.

- Austria, 64 616. Groat mill.
63 010. Drainage and ditching machine.
- France, 462 938. Milking machine.
463 049. Apparatus for milking cows.
463 623. Attachment for churns for getting rid of the butter milk.
463 846. Improved sharpener for the knives of chaff cutters and similar machines.
463 851. Apparatus for charging compressed air sprayers.
463 895. Device for unfastening animals in stables.
464 203. Apparatus for protecting crops from frost.
463 301. Cone-shaped attachment for nozzles of sprayers.
- Germany, 272 026. Motor straw elevator.
272 202. Apparatus for singling plants sown in rows.
272 205. Ditching plough.
- Hungary, 62 046. Beet pulp press.
62 130. Cereal cleaner.
- Italy, 130 970. Esiccators for rice, maize, pomace, etc.
131 908. Spherical elastic valve for horizontal tube of sprayers.
134 451. Improved sulphurer.
135 549. Floating weeding machine.
135 964. Apparatus for driving automatically any sprayer mounted on wheels.
136 215. Portable continuous action hydraulic press.
- Switzerland, 65 489. Device for introducing honeycomb frames into or removing them from hives.
63 517. Process for freeing peat from water.
63 565. Apparatus for extracting the juice of fruit by means of steam.
63 759. Centrifugal separator.
63 764. Straw baler.
63 767. Apparatus for the destruction of pests such as flies, by means of electricity.
64 646. Machine and process for the preparation of farmyard manure.
64 702.4. Apparatus for grading and cleaning grain groats, grain, etc., by means of statical electricity.
61 705. Process and apparatus for the dry preservation of eggs.
- United Kingdom, 25 000. Cow milkers.
25 641. Spraying nozzles.
25 767. Butter churn, grinder and worker.
26 032. Machine for treating oil palm fruits.
26 065. Sharpener for knives of chaff cutter.
26 322. Driving gear for chaff cutters.
26 416. Instrument for tapping rubber trees.
- United States, 1 087 309. Flax puller.
1 090 709. Machine for heading Kafir corn.

566. - **The Shower-Bath System of Sheep Dipping.** — *The Implement and Machinery Review*, Vol. XXXIX, No. 468, p. 1660. London, April 1st, 1914.

The accompanying illustration shows the new shower-bath system of sheep dipping, which appears to be finding favour in Queensland. It consists of a shed 40 ft. long by 12 ft. wide, the roof of which is of flat, perforated iron sheets. The dip is pumped by a 3 in. centrifugal pump

from a tank to the roof and falls through the perforations on to the 200 sheep beneath, the shower lasting about seven minutes. The roof edges are turned up to prevent the dip running off and the sides of the shed are enclosed to obviate the blowing about of the dip. There are about 35 holes to the square foot.

This method is proving entirely satisfactory, the cost in one case being stated to be $\frac{1}{2}$ d per head. One thousand sheep per hour can be dipped without undue haste by four men.

RURAL ECONOMICS.

567 - **The Economic Importance of Beet Growing.** — SAGAWÉ, B. in *Archiv für exakte Wissenschaftsforschung*, Vol. 6, Part I, pp. 157-209. Jena, 1914.

The writer examines and discusses the importance of beet growing, and investigates the soundness of the frequently recommended principle: "extensiv organisieren und intensiv kultivieren" (cultivate intensively in extensive farming) which tends to increase the growing of forage plants at the expense of beets.

He mentions first the results of some investigations into the labour required for growing beets by WATERSTRADE, WERNER, DETTWEILER and LANGENBECK, wherein it is shown without exception, that the amount of labour in a farm increases with the proportion of the land under beets. On the other hand the results do not agree as to the difference of the amount of labour required in the most intensive and the most extensive farms. Before diminishing the acreage of beets in favour of forage crops in order to overcome the difficulty of procuring labour, it is necessary to have a clear idea of the consequences of such a change and of the other economic factors involved in beet growing, such as its profitableness, its value as a source of forage and its effect upon the utilization of labour.

All investigations made up to the present have shown that beet growing is one of the most important elements of profits of farms in arable districts. In part 180 of the *Arbeiten der Deutschen Landwirtschafts-Gesellschaft* (Transactions of the German Agricultural Association) LANGENBECK examined the effect of the acreage of root crops on farming conditions in 42 farms and came to the conclusion that the increase of root crops leads to the increase of live stock, to the increase of the value of the dead stock, to the increase of the outlay on artificials, concentrated foods, and salaries and to the increase of the returns from animal and vegetable products, of the net returns and of the capital invested. Part 214 of the *Arbeiten der D. L. G.*, dealing with farming in Silesia, as well as some previous work of the present writer on the profitableness of root crops (1), lead to the same results. The statistics of the Silesian Chamber of Agriculture show that when the farms are arranged according to the percentage of their area devoted to beets the same conclusion is reached. (Table I).

(1) See No. 407, B. April 1913.

(Ed.).

TABLE I.

Root crops per cent of area	Total value per acre	Gross returns per acre	Outlay per acre	Net returns per acre	Interest per cent
	£ s d	£ s d	£ s d	£ s d	
1910-1911					
Under 15	33 2 6	4 14 5	4 17 1	5 2	0.8
15-20	40 13 4	6 1 5	5 3 7	1 1 0	2.6
20-25	43 8 11	7 4 5	5 17 5	1 12 6	3.7
25-30	47 7 11	9 7 8	7 0 1	2 11 2	5.2
Above 30	37 18 8	12 10 5	9 9 4	3 2 8	5.5
1909-1910					
Under 15.. . . .	44 16 8	5 4 0	5 5 1	15 6	1.7
15-20	34 14 4	4 7 11	14 14 4	1 3 10	3.4
20-25	14 17 4	7 1 7	5 14 4	1 14 6	4.2
Above 25	51 19 6	10 6 8	8 10 7	2 16 8	5.5
1908-1909					
Under 15.. . . .	45 12 6	5 9 1	5 0 0	7 11	0.9
15-20	37 9 11	5 15 6	5 5 6	17 1	2.3
20-25	38 12 11	6 19 4	5 15 6	1 7 0	3.5
Above 25	51 11 7	9 16 10	7 13 11	2 11 7	5.0

In their work on the returns of Moravian peasant farms (*Ertragsfähigkeit der mährischen Bauernbetriebe*, Brünn 1911) HOWARD and OSTERMAYER come to the same conclusion: that the rate of interest yielded by the capital invested depends directly upon the acreage of the root crops.

The question of the consequences of substituting forage for beet crops can only be correctly solved by a careful comparison of the amount of forage produced by the two crops. The writer makes this comparison, calculating the cost of the forage supplied by both according to their technical food value, and using the values of HOWARD and OSTERMAYER for the purpose. He assumes the leaves of beetroots to be one third of the crop, that the ratio of grain to straw is 1:2 in wheat and rye, 1:1.5 in oats and 1:1.33 in barley, and finds that the cost of production of one hundredweight of food units is as follows:

	According to Howard	According to Ostermayer
	s d	s d
Winter wheat	6 10	7 5
Winter rye	7 1	8 0
Barley	6 8	6 7
Oats	7 6	7 4
Beets ¹	4 4	3 8
Mangolds	— —	8 10
Potatoes	7 11	9 2
Clover hay	— —	4 8
Meadow hay	— —	4 10

According to the above, beets produce the cheapest food units, cheaper than meadows and clover leys. But the question arises whether beets should be compared to hay or rather to fresh clover and grass, as in making hay a considerable loss of food units takes place and the cost of production increases. But as it is generally impossible to feed all the clover and meadow grass in its fresh condition, the writer is of opinion that the comparison of beets and forage plants should not be made between the former and hay, nor between the beets and the green food, but between the food value of part green food, part hay on the one hand and of beet leaves in the state in which they are utilized on the other. Not the quantity at the time of the harvest but the available quantity in the condition in which it is fed, should be calculated, because a certain loss of food units takes place during the storage of roots and leaves. On this plan, the writer has calculated the cost of production of forage, in the state in which it is fed, from twelve yearly accounts of several Silesian farms in different years, and determined the price of one hundredweight of food units in:

	<i>s</i>	<i>d</i>
Clover	3	0
Lucerne	3	2
Beets	4	4
Meadow grass	4	9
Mangolds	7	10
Potatoes	7	10 ½

from which it appears that the food unit in beets is dearer than in clover and lucerne, but cheaper than that of meadow grass.

The exclusive consideration of market prices leads to erroneous conclusions, as does the neglect of the unmarketable products produced on a farm, for the farm itself must be considered as the market. The valuation on physiologico-economical basis (1) is also erroneous, because by this method the price of the starch unit delivered at the farm is taken as basis, and thus the unmarketable products are given a value plus cost of carriage, while the marketable ones get a value minus the same. But apart from this it is a mistake to make the starch unit the basis of the price of foods which are not sold in the condition in which they are fed, for this way of valuing, though correct from the physiological point of view, is unsound from the economic point of view, because the unmarketable field products can only be made marketable by means of live stock.

The profitability of beet growing is much influenced by the valuation of its by-products. If beet leaves could be sold on the market, their value on the farm would be the market price minus cost of carriage. If, therefore, their value is to be calculated from the market prices of the marketable foods, from every hundredweight of the farm forage the cost of transport per cwt. of marketable food must be deducted; the actual cost of carriage of the marketable food must not be set off against the total quantity

of the unmarketable produce. But for beet leaves it does not seem advisable to take the marketable foods as basis of their valuation, on account of the interdependence of beet growing and live stock for the production of stable manure and forage. Beet leaves must therefore be sold to the live stock at a price which leaves a margin of profit for the beet account. This intermediate value of farm bye products varies according to food units, or price per unit in marketable foods minus the cost of carriage per hundred-weight, and the minimum value or manurial value plus cost of storage.

The writer then discusses the intimate connection between live stock and beet growing for the utilization of farmyard manure, and shows that from this point of view also a substitution of forage crops for beet would be equivalent to buying dearer forage and getting a lower value for the farmyard manure, and would result in a decrease rather than an increase in the profits from the live stock and consequently from the whole farm, provided that the growing of beets had not yet exceeded its most profitable limits.

With the increased acreage of beet, the utilization of labour improves. The writer proves this by classifying the farms which send their books to the book-keeping office of the Silesian Chamber of Agriculture according to the acreage devoted to beets, and calculates the ratio of outlay on labour to gross returns (Table II).

TABLE II. — *Wages in percentage of gross returns.*

Year	Acreage in root crops				
	less than 15 %	15-20 %	20-25 %	25-30 %	above 30 %
1910-11	39	35	31	28	26
1909-10.	41	36	32	27	23
1908-09.	35	36	31	27	60
Average . . .	38	36	31	27	23

The larger the relative acreage of root crops the smaller the outlay on wages required for the same gross returns. This result is due to the well known fact that with increasing intensity of farming labour diminishes in relation to the capital invested. The higher absolute outlay on labour is justified by the increasing profits of the farms, the means of which for the three years amount to 1.1, 2.8, 3.8, and 5.2 per cent. respectively for the first four groups.

The same results are obtained from farms under the book-keeping control of the D. L. G. using LANGENBECK's and OSTERMAYER's figures. In order to show that these results are not due to the improvement in the quality of the soil and in the economical conditions of the beet farms rather than to the increase of root crops, the writer shows that by grouping the farms according to their increasing total value, the amount of labour employed in the D. L. G. farms shows no difference, that the figures of the Silesian farms show an increase in the amount of labour employed but

that the increase is quite insufficient to account for the fall of the ratio with the increased acreage of root crops.

The statement that beet growing is often pushed beyond its most profitable limits is not confirmed by the results of the accounts, which show that the interest on the capital invested still gives an increase when the root crops attain upwards of 35 per cent of the total acreage, notwithstanding the fact that the proportion of net returns to gross returns or the factor "value according to returns" (*Ertragswert*) appears to reach its highest limit with about 30 per cent. of the total acreage under roots. In order to determine the optimum limit of any crop which has reached the ultimate profitable limit of outlay, it is not enough to consider only the absolute value of the net returns or the ratio of outlay to gross returns, but rather the rise or fall of the rate of interest on the total capital. The figures calculated on these lines for the D. L. G. farms show that cereal crops reach the optimum limit of profitability and in the use of labour at about 60 per cent., while root crops attain this same limit at about 30 per cent. with regard to the use of labour but not with regard to the highest rate of interest. It follows that such districts as do not seem especially suitable to extensive forage crops on account of their position and natural conditions should only devote a relatively small percentage of their area to these crops.

568 - **The Consumption of Artificial Manures in Intensive Agriculture.** — HAGMANN in *Landwirtschaftliche Zeitschrift für die Rheinprovinz*, Year 15, No. 16, pp. 315-316. Bonn, April 17, 1914.

One of the most valuable means of judging the degree of intensity of the cultivation of a farm is a knowledge of the kind and amount of the artificials used on it; thus the average outlay on artificials in the year 1912-13 on 36 farms in the Russian Baltic provinces was 2s 6d per acre of cultivated land, on 145 farms in East Prussia 7s 4d, and on 18 intensive farms of the Rhine province £1 5s 4d per acre. These figures afford a better index of the degree of intensity than any other item of expenditure.

In the total outlay for the Rhine province, nitrate of soda and sulphate of ammonia amount to 6s 5d, "Ammoniaksuperphosphat" (a mixture of superphosphate and sulphate of ammonia) to 12s 10d, superphosphate and basic slag to 2s 4d, potash salts and kainit to 2s 5d, and lime to 1s 4d. If these figures be classed according to the percentage of the various elemental plant nutrients, it will be found that nitrogen represents about 60 per cent., phosphoric acid 25 per cent. and potash and lime each 15 per cent.

The two principal sources of nitrogen are farmyard manure and artificials. The question of the best proportion in which these two are to be used is of great importance with regard to the profitability of the whole farm. As the number of live stock kept increases, the necessity of supplying nitrogen in the form of artificials decreases, as is shown in the 18 Rhine-land farms which are divided into two groups according to the amount of live stock kept, with the following results (Table I):

Groups	Number of farms	Live stock per acre		Outlay for artificials per acre							Lime														
		Total	Cattle	Total	Nitrate of soda and sulphate of ammonia	Superphosphate of ammonia	Superphosphate and basic slag	Potash and kainit																	
		£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d						
I	9	8	11	4	9	8	11	0	0	5	8	0	10	10	0	11	0	11	0	0	8				
II	9	5	19	5	2	11	12	1	9	7	0	7	1	0	14	11	0	2	11	0	2	12	0	1	11

The outlay on artificials is much greater in group II than in group I and especially is this the case for nitrogen. The gross and net returns are very similar in both groups, as the difference in the amount of live stock kept is not large. If, however, farms are taken where the difference is greater, the influence of the live stock on the amount of fertilizers purchased, especially of nitrogen, as well as on the profitableness of the farm is more evident. The writer has taken from the *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 130, the figures relating to 20 sugar-beet farms in Saxony, 10 of which keep much live stock and the other 10 only a limited quantity, other conditions being equal. It appears that the first group, which keeps 31.56 units of live stock per 100 acres buys 337 lbs. per acre of nitrate of soda and sulphate of ammonia annually, while the second group, which keeps only 12.54 units per 100 acres, consumes every year 713 lbs. per acre. The consumption of «Ammoniaksuperphosphat» is approximately equal, viz. 301 lbs. per acre in the first group and 298 lbs. in the second. The net returns are £4 4s 11d per acre in the first group and £2 12s 5d in the second. The above figures prove clearly that the net profits are connected with the quantity of live stock kept on the farm and increase with it. The writer is therefore of opinion that in every farm where large quantities of nitrogenous fertilizers are bought regularly, it should be ascertained whether the amount of live stock could not be increased and the amount of purchased fertilizers correspondingly decreased.

AGRICULTURAL INDUSTRIES.

569 - Determination of the Viscosity of Milk as a Means of Detecting the Addition of Water. — KOOPER, W. D. (Communication from the Laboratory of GERBER Co. Ltd., Leipzig) in *Milchwirtschaftliches Zentralblatt*, Year 43, Part 7, pp. 169-179 and Part 8, pp. 201-208, Hanover, April 1 and 15, 1914.

DAIRYING

The writer examined 50 different mixed milks, with the object of investigating the question of utilizing the viscosity of milk as a means of detecting the addition of water. The fat content and specific gravity

were determined at the same time by the Gerber and lactometer tests respectively, and the total dry matter was calculated from these values by Fleischmann's formula. The viscosity was determined by means of a specially constructed burette-shaped apparatus. This was first filled with distilled water, then with milk; for both, the time required for the outflow of 10 cc. was observed.

$$\text{Viscosity constant, } V = \frac{\text{outflow of milk, time in seconds}}{\text{outflow of water, time in seconds}}$$

In order to get comparable results, the tests must be carried out at uniform temperature, differences of 0.5° C. (0.9° F.) having a perceptible effect, and the bore of the outlet must be adjusted so that the outflow be neither too fast nor too slow. The milk must be thoroughly well mixed before being poured into the burette, without subjecting it to too violent shaking which might cause a change in the natural viscosity of the liquid. The time required for the outflow must be determined with precision to within one-fifth of a second.

A high viscosity constant is usually associated with a high fat content, but the rule is not infallible, nor is the ratio of the specific gravity to viscosity constant more reliable. On dividing the average viscosity constant (1.588) by the average dry matter of the milk (11.472 per cent.), the factor 0.1384 was obtained, and if there be any constant relationship whatever between viscosity and dry matter content, the dry matter of any one sample (or T) should be given by the formula :

$$\frac{V}{0.1384} = T$$

On comparing values thus obtained with those obtained by using the Fleischmann formula for the 50 samples investigated, it appeared that the greatest divergence between the two methods amounted in one case to 0.36 per cent. All the other samples showed smaller differences, so that the writer concluded that a direct relationship existed between variations in the viscosity and the dry matter content of milk.

In using the viscosity constant for detecting the addition of water to milk, experiments showed that under certain conditions watered milk can yield the same viscosity constant as unadulterated milk, in which case the value obtained for T is too high; the greater the amount of water added to the milk the greater is the difference between the real and calculated value for dry matter, owing to the fact that the watering causes the amount of dry matter to diminish more rapidly than the viscosity constant. If a milk for instance with 11.472 per cent. of dry matter and a viscosity constant of 1.588 be mixed with an equal quantity of water, the percentage of dry matter would be reduced to $\frac{11.472}{2} = 5.736$; but the viscosity constant would only be reduced to about $\frac{1.588 + 1}{2} = 1.294$. From this :

$$T = \frac{V}{0.1384} = \frac{1.294}{0.1384} = 9.349 \text{ per cent.};$$

that is, the difference between the real and calculated values for the dry matter would be :

$$9.349 - 5.736 = 3.613 \text{ per cent.}$$

The difference between the amounts of dry matter determined by the two methods therefore affords an easy and rapid way of ascertaining whether milk has been watered, and if so to what extent. The writer recommends that the question be further investigated.

570 - **Biorized Milk** (1). — KLUNKER, chief physician to the Institute of Hygiene at the University of Jena, in *Molkerei Zeitung*, Year 28, No. 33, pp. 625-626, No. 34, pp. 639-640. Hildesheim, April 29, May 1, 1914.

The above paper is a preliminary communication of an investigation of LOBECK'S milk sterilization process, carried out at the Institute of Hygiene, University of Jena, with an experimental apparatus capable of treating 2.64 gallons per hour. Samples of biorized milk from Leipzig, Chemnitz and Düsseldorf, where the process is in use, were sent for comparison, and the results obtained are as follows :

1. The whole apparatus is easy to handle, to dismount, to clean and to disinfect. The daily initial loss of milk is very small.

2. The biorized milk (called by LOBECK "enzyme-milk") is equal in colour, appearance, smell and taste to the best raw milk.

3. This milk is somewhat less easily skimmed than raw milk, but at the temperatures employed, viz. 131 and 135° F., the difference is so small that it would be imperceptible to consumers. Equally good results can only be obtained with heated milk if the temperature be kept below 113° F. and the heating be continued for half an hour ; no milk pasteurized in any other way approaches biorized milk in this respect.

4. The original enzymes (oxydases) of natural milk are not influenced by biorization ; the milk proteins undergo no change. On the other hand coagulation proceeds more slowly but is not weakened.

5. Biorization causes such a decrease in the germ content that the keeping quality of the milk is more than doubled. As moreover the heating to 131 and 135° F. does not destroy the lactic acid producers, there is no danger that the milk will be spoiled while on sale by the prevalence of spore-forming bacilli. Biorized milk can therefore compete with fresh, cleanly milked raw milk as food for babies.

6. Disease-producing germs, such as typhus, paratyphus, diarrhoea, cholera and diphtheria bacilli, are destroyed with absolute certainty. The destruction of the tubercle bacilli is less certain, but experiments seem to indicate that they do not resist the treatment.

The new process would appear to mark a distinct forward step towards supplying a hygienic, wholesome milk to the public..

- 571 - **The Effect of Certain Dairy Operations upon the Germ Content of Milk.** — HARDING, H. A., RUEHLE, J. K. etc., *New York Agricultural Experiment Station, Bulletin No. 565*, pp. 197-233. Geneva, N. Y., August 1913.

Bacterial counts were made in milk samples produced under various conditions of hand-milking. Neither plastering nor whitewashing the byre, nor clipping the udder and flank of the cows, nor the use of a vacuum machine for cleaning the cows preparatory to milking, seemed to have any effect on reducing the bacterial content of the milk; in fact the opposite effect was usually observed. A series of tests carried out on samples drawn from the milking pail, from the cooler, and after final straining, indicated that the germ content of the milk was not increased by the handling it received on the farm subsequently to the milking operation.

- 572 - **The Origin of Some of the Streptococci Found in Milk.** — ROGERS, L. A. and DAHLBERG, A. O. (Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. I, No. 6, pp. 497-511, Washington, D. C., March 1914.

A collection of cultures of streptococci was made, of which 42 were isolated from normal milk, 51 from infected udders, 114 from bovine faeces, and 39 from the mouths of cows. These were all subjected to a large number of tests and tabulated according to their behaviour on gelatine and in media containing dextrose, lactose, saccharose, raffinose, starch, inulin, mannite glycerin, dulcitol and adonitol. The cultures fall into groups according to the nature of the material from which they were originally isolated.

WINE-MAKING.

- 573 - **Improvement of Damaged Wines and Spirits.** — ZWEIFLER, F. in *Allgemeine Weinzeitung*, No. 18, pp. 185-186. Vienna, 1914.

The writer carried out some experiments on the improvement of damaged wines at the Agricultural Experiment Station of Marburg (Styria), during which the following results were obtained.

1. A turbid highly coloured wine with a musty odour and taste was treated with sesame oil, but ineffectually. On increasing the dose of oil the smell of the latter was communicated to the wine. On adding 0.16 oz. of Eponit (1) per gallon of wine and filtering it after six days, the wine became light coloured and clear, and tasted clean.

2. Another wine that had become dark brown was treated with 0.008 oz. of sodium bisulphite, 0.0096 oz. of gelatine and 0.008 oz. of tannin per gallon, with the result that the colour became clear and the wine kept well. Equally good results were obtained by using 0.064 oz. of Eponit and 0.008 oz. of sodium bisulphite alone.

3. A sour turbid wine with a taste of the cask (total acidity 12.7 per thousand) on being treated with 0.24 oz. of precipitated carbonate of lime, 0.0192 oz. of gelatine and 0.016 oz. of tannin per gallon, became clear and mild and pleasant to the taste. Sesame oil had no other effect than that of imparting its smell to the wine.

(1) "Eponit" is a vegetable charcoal, a new clarifier which has given good results. It is sold by the AKTIEN GESELLSCHAFT DER OESTERREICHISCHEN CEREN FABRIK, late H. UJSELY AND Co., of Stockerau near Vienna.

4. White wine made with red grapes was decoloured in order to blend it with another white wine. In one case 0.12 oz. of Eponit per gallon was sufficient, while another wine required 0.16 oz. per gallon.

5. Two plum brandies which had become black were clarified, one with tannin and gelatine, and the other with skimmed milk; the results were imperfect in both cases, while 0.368 oz. of Eponit, though working slowly, rendered the brandy perfectly clear and its taste quite clean. An equally good result was obtained by adding water to the brandy and redistilling it.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

- 574 - Decree Placing *Mytilaspis citricola* (= *Lepidosaphes beckii*) amongst Notifiable Insects in Uruguay. — *Revista de la Asociación rural del Uruguay*, Year XIII, No. 12, p. 683. Montevideo, 1913.

At the request of the "Defensa Agrícola", and on evidence of damage caused by this insect to orange plantations in certain districts, the President of the Republic issued a decree, dated October 25, 1913, that *Mytilaspis citricola* (*Lepidosaphes beckii*) should be classed as an insect injurious to plants according to art. 7 of the law of October 21, 1911.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

- 575 - Observations and Researches on "Dörrfleckenkrankheit" (Dry spot Disease) of Oats. — HILTNER, L. in *Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year 12, Part 3-4, pp. 28-41, 1 fig. Stuttgart, March-April 1914.

A disease of oats generally called "Dörrfleckenkrankheit" has been observed in various districts in North Germany during recent years and has frequently appeared in Holland, Denmark and Sweden. The leaves develop normally at first, but fairly early lose their turgescence at the bends; the wilted portions soon change colour and perish. If the disease appears when the plants are young, as is often the case, the yield of the crop is greatly reduced, since many of the panicles do not emerge from their sheaths.

The disease has been attributed either to a fungus, *Scolecotrichum graminis*, or to root nematodes, or to the frit fly (*Oscinis frit*). The majority of observers, however, consider it due to unfavourable soil conditions, particularly the percentage of lime.

Pot culture experiments carried out by the writer (Director of the Agricultural Botanical Station of Munich) show that: 1) the disease apparently does not occur on compact clay soils; 2) it appears in cultures

of ordinary garden soil containing lime, without direct addition of lime ; 3) treatment of this soil with carbon disulphide does not prevent the outbreak of the disease ; 4) no disease appears on soil treated with quicklime and carbon disulphide, but carbonate of lime and carbon disulphide are without effect in checking the disease. The effect of the quicklime in combination with carbon disulphide is accounted for by its action on the increased ammonia produced after the treatment with carbon disulphide, resulting in increased nitrification and the formation of calcium nitrate.

In field cultures the disease increased considerably after abundant rain ; this causes the formation of bicarbonates of soda and potash by double decomposition of alkaline salts with the carbonate of lime in the soil.

Water cultures lead to the conclusion that the disease is not caused by the presence of lime itself, but by the resulting decomposition products formed either in the soil or in the leaves of the oats. The researches show that : 1) in nutritive solutions containing monopotassium phosphate, normal development of the oat and other plants is impossible when the solution is made with un-neutralised tap-water containing lime ; chlorosis develops rapidly owing to the alkalinity of the surface-film of the solution, and the functions of the roots are checked ; 2) in Knop's solution made with Munich tap-water neutralised with sulphuric acid, the oat plants develop relatively better, but the leaves are subject to the disease ; the chemical decomposition causing the alkaline reaction evidently takes place in the leaves in this case ; 3) since the addition of monopotassium phosphate to garden soil containing lime can cause the development of the disease in oats, it is concluded that as in the case of water cultures, the appearance of the disease is determined chiefly by the alkaline decomposition products formed in particular by the action of the bicarbonate of lime.

The different varieties of oats show varying degrees of resistance to the disease. Pot cultures have shown that the variety Leutewitzer Yellow is more resistant to the frit fly than Fichtelgebirg, and that it remains free from disease in garden soil rich in lime, whilst Fichtelgebirg is badly attacked. In soils poor in lime the disease does not appear in either variety. The writer considers the yellow varieties less susceptible to the metabolic disturbances which give rise to the disease. The fungus *Scolecotrichum* appears later on all the diseased plants, but it cannot be the cause of the disease since it is only developed to any considerable extent on certain types of soils.

The functional disturbances of the leaves may be prevented by spraying with a solution of iron salts. A diseased culture of Fichtelgebirg oats was effectively cured after four sprayings with $\frac{1}{2}$ to 2 per cent. solutions of iron salts. Tartrate of iron gives the best results.

It has also been found that oats which have become chlorotic owing to the presence of alkaline substances in the nutritive medium, or which suffer from the disease owing to the formation of injurious alkaline products in the leaves, can be cured by spraying with salts of iron. This would explain the satisfactory development of oats which is often noted after spraying for wild radish with sulphate of iron.

The writer has also determined the identity of the disease known as "Haftersucht" in the Bavarian Alps, and "Holsternische Haferkrankheit" or "Moorkoloniale", with "Dörrfleckenkrankheit". The researches are being continued to determine the effects of acid and alkaline fertilizers.

576 - The Presence of Endocellular Fibres in the Tissues of the Vine and of other Dicotyledons (?). — MAMELLI, EVA in *Ann. dell'Istituto botanico dell'Università di Pavia*, Series II, Vol. XVI, pp. 47-65, plate VIII, Milan, 1914.

In this summary the writer fully confirms her preceding observations (2).

The presence of endocellular fibres is frequent, not only in the vines affected by bramble-leaf (roncet), but also in healthy ones (86 per cent.); vines grown in districts hitherto free from bramble-leaf and showing no exterior symptoms of this disease or of decay, may contain these endocellular fibres even in the two-year-old canes.

Between healthy vines and those suffering from bramble-leaf, there is no difference at all either in the form or in the frequency of the fibres: these may be rare or wanting altogether in both.

The formation of the fibres cannot be attributed to falls of temperature, because their presence has been ascertained by the writer in vines and other plants grown for several years in hot-houses.

The writer has found these fibres in *Vitis vinifera* L. and *V. heterophylla* Thunb., as well as in nineteen other dicotyledonous plants belonging to the most different families, so that their presence has no connection with any pathological condition of the plant which contains them. The origin and function of the endocellular fibres are in all probability mechanical.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

577 - Phytopathological Observations in the Grand Duchy of Baden, 1913. -

WAHL, C. von and MILLER, K. in *Bericht der Hauptstelle für Pflanzenschutz in Baden an der Gossler'schen landwirtschaftl. Versuchsanstalt Auensteinburg für das Jahr 1913*, pp. 70, + 5 figs., append. I and II. Stuttgart, 1914.

A list is given of the cultivated plants and their pests observed during 1913.

Phylloxera (*Phylloxera vastatrix*) was recorded for the first time in the Grand Duchy of Baden. *Conchylis ambiguella* caused serious damage, whilst the vine mite (*Phyllocoptes vitis*) and the vine tortrix (*Tortrix pilleariana*) have diminished.

American gooseberry mildew (*Sphaerotheca mors-uvae*) has spread everywhere.

Experiments on the destruction of meadow saffron (*Colchicum autumnale*) have been started; the seeds are not distributed by irrigation,

(1) See No. 480, B. May 1914.

(Ed.).

(2) See No. 1207, B. Oct. 1913 and No. 289, B. March 1914.

(Ed.).

since they sink in water, but apparently by means of hay seeds; in 4 $\frac{1}{2}$ lbs. of hay seeds 790 of these seeds were found.

Experiments on protective measures against plant pests.—Comparative trials of the fungicidal action on vine mildew (*Plasmopara viticola*) have been made with certain commercial fungicides and Bordeaux mixture. "Cerdidymsulfat", "Malacidschwefel" and "Laykoschwefel" were tried and found inferior to Bordeaux mixture. They were particularly useless against mildew in 1913, when the weather was very favourable to the disease.

Applications of 20 per cent. solutions of sulphate of iron were used against the "Grind" disease of the vine, with only partial success; the disease reappeared on the treated vines but in a less degree.

Experiments on the destruction of charlock and radish have shown again the value of a 20 per cent. solution of sulphate of iron, a dressing of kainit of about 90 lbs. per acre, and a 20 per cent. solution of "cuproazotin." (1). Calcium cyanamide at the rate of 1 cwt. per acre did not come up to expectations.

"Malacidschwefel" does not fulfil its claims in the destruction of aphids. "Urania-Grün", based on aceto-arsenite of copper, produces a more permanent suspension in water than "Malacidschwefel", but is not more effective.

Prof. Lang's "Schwefelaluminiumpatronen" were not successful against hamsters and rabbits, owing to the depth of their winter burrows, but they were effective against water voles.

Immersion of seeds in creolin, carbolineum, or formalin and coal-tar is not a safe protection against the attacks of birds. Carbolineum in 5 per cent. solution is injurious to the germinating power of the seeds.

Various observations.—The results of the investigations on the introduction of phylloxera into the Grand Duchy are not conclusive; it does not appear to have been due to winged individuals coming from Upper Alsace.

Winter spores of *Plasmopara viticola* have been found in abundance on vine leaves, and the perithecia of the powdery mildew (*Uncinula necator*) were abundant on vines near houses at Durlach.

Infection experiments on *Rhytisma acerinum*, the fungus of sycamore leaf-blotch, have confirmed former experiments, which showed that infection takes place on the under side of the leaf and not on the upper surface as maintained by Tubenf.

The organization against plant diseases in the Grand Duchy has been still further improved by the collaboration of lecturers on fruit and vine growing, and by the creation of a station for purchasing the materials required. The Central Station for the Protection of Plants organises special visits to farms where modern methods of control are demonstrated and lectures are held to stimulate the interest of farmers in the aims of phytopathology.

(1) Supplied by Ludwig Meyer, Mainz; price about 30s per 100 lbs.

FUNGI

578 - **Some Chinese Fungi** (1). — MIYAKE ICHIRO, in *The Botanical Magazine*, Vol. XXVIII, No. 327, pp. 37-56, plate I. Tokyo, March 1914.

A systematic catalogue of more than one hundred species and varieties collected by the writer in various localities during the summer of 1912. The majority were found on cultivated or economic plants. Of the seven species new to science the following are worthy of mention: *Rehmiella ulmicola*, on the leaves of *Ulmus* sp.; *Coniothyrium Tiliae*, on the leaves of *Tilia cordata*; *C. Spirææ*, on the leaves of *Spiræa pubescens*; *Septogloeum Anemones*, on the leaves of *Anemone* sp.

The following species are already known: *Gymnosporangium Yamadae* Miyake, common on leaves of *Pyrus Malus* and *P. spectabilis* near Pekin; the disease often spreads so rapidly in June and July that all the foliage turns yellow, dries up and falls; *Aecidium Mori* Barcl., on the leaves of *Broussonetia Kazinoki* and *Morus alba*, widespread and injurious in Japan; *Helminthosporium Onyzae* Miyake and Hori; from observations made by the writer, this latter fungus is not so widely distributed or dangerous in China as in Japan.

579 - **Wintering of Cereal Rusts in the Uredo Stage.** — MONTMARTINI, LUIGI in *Rivista di Patologia vegetale*, Year 7, No. 2, pp. 40-44. Pavia, 1914.

The writer reviews the results of other workers on the persistence of the uredospore stage during the winter months. He records the fact that at Pavia and in its Province this form of rust occurs on wild and cultivated Gramineae, which continue green after harvest, and that it may reinfest the wheat plant at any time. Thus, autumn-sown wheat may be directly infected, and if the season is warm and late the disease makes its appearance. The uredo stage also appears to be able to resist several degrees of frost for many days. Further observations are required to determine the temperature which is fatal to the parasite. Under Italian conditions it seems more probable that the infection of the wheat crop takes place by means of uredospores from diseased plants during the autumn, rather than by transmission through the seed as supposed by Eriksson.

The spread of the disease is therefore influenced by the growth of grasses, the summer weather (during hot, dry summers, when grasses dry up, the uredo stage gives place to the teleuto stage), the period of sowing and the autumn and winter weather.

580 - **Inoculation Experiments on Potatoes with *Fusarium*, 1913.** — HIMMELBAUER, W. in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year XLIII, Part I, pp. 1-16. Vienna, 1914.

Experiments were carried out in 1913 to confirm the results obtained in 1912 on a small scale. Inoculations were made, as in 1912, of vigorous material, using mycelium only. In addition to direct insertion in the tissues of the plant, inoculations of the soil were made in the immediate neighbourhood of the plants. The experiments were begun on the 19th

of July, and the inoculations were made on fine days between 6 and 8 a.m. in the open fields which had previously shown no sign of the disease. It was found that inoculations of the potato haulm resulted in the appearance of leaf-curl, thus proving that one form of leaf-curl in potatoes is due to infection of the haulms by the various forms of *Fusarium* (and also *Verticillium*).

58r - **A Leaf Disease of *Cycas revoluta*.** — MARCOLONGO, I. in *Rivista di Patologia Vegetale*, Year 7, No. 1, pp. 6-8. Pavia, 1911.

For many years a number of specimens of *Cycas revoluta* in Naples have been attacked by a leaf-disease, characterised by small round yellow spots with dark edges, which extend until the whole segment of the leaf is yellow. A slight greenish mould appears on the underside of the leaf and thickens as the disease advances. Microscopic examination has shown that this disease is due to a new species of *Cladosporium*, provisionally described as *C. Cycadis*.

In gelatine cultures nothing has been obtained but a pycnidial form, capable of reproducing itself from the stylospores. Inoculations of healthy leaves with either the conidial (*Cladosporium*) or the pycnidial (*Phoma*) stage, have produced the characteristic symptoms of the disease.

582 - ***Cylindrosporium Juglandis* injurious to the Leaves of Walnut in Alabama.** — WOLF, A. in *Mykologisches Centralblatt*, Vol. IV, Part 2, pp. 65-69 + figs. Jena, March 1914.

During the last two years walnut trees at Auburn, Alabama, have shown a new leaf disease characterised by numerous irregular dry spots which appear on both sides of the leaf. The spots are brown in colour with a central grey spot indicating the point of infection. Some spots are uniformly brown and others become uniformly grey owing to the entrance of air below the raised cuticle. The adjacent tissue often becomes chlorotic. A single leaf may develop from 500 to 1000 or more centres of infection, which may remain distinct or may join up so as to cover the whole leaf surface. In the summer of 1912 a small plantation was so badly attacked that the trees were completely defoliated on two occasions before the normal period of leaf-fall.

The disease is caused by a *Cylindrosporium*, the fructifications of which appear on the under sides of the leaves. The fungus has been isolated in pure cultures and reproduced with success in various media, but no perithecia have been obtained in artificial cultures. Supposing that the conidial stage survives on the fallen leaves until the new leaves appear, it does not seem probable that perithecia are produced in the neighbourhood of Auburn. It is probable that the perfect form of this fungus could be produced under certain conditions, as in the case of other species of *Cylindrosporium*.

Experiments in 1913 showed that the disease could easily be kept in check by destroying all fallen leaves from the diseased trees, and using Bordeaux mixture on the appearance of the disease. The writer describes this fungus as *C. Juglandis*.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

- 583 - Experiments on the Destruction of Charlock (*Sinapis arvensis*) by Mechanical and Chemical Means. — LEUTZ, J. VON in *Praktische Blätter für Pflanzenerbau und Pflanzenschutz*, Year XII, Part 3-4, pp. 43-46. Stuttgart, March-April 1914.

The results of two years' experiments show that rolling is more effective than spraying with sulphate of iron for destroying charlock; it must be done as soon as the oats appear above ground. The rolling must be very thorough, so as to crush all the charlock seedlings, and is best repeated a second time; on stony or cloddy land this method is not applicable.

INSECT PESTS.

GENERALITIES

- 584 - Relation between the Larvae of Vine Moths (*Conchylis ambiguella* and *Polychrosis botrana*) and the Weeds of Vineyards and Other Plants. — LÜSTNER, GUSTAV, in *Zeitschrift für Weinbau und Weinbehandlung*, Year I Part I, pp. 3-35. Berlin, 1914.

The writer has conducted numerous experiments to determine what foods other than the flowers and fruits of the vine are available for these insects during their larval stage. He tried the larvae with 92 species of plants, the majority being vineyard weeds, others hedgerow and ornamental plants.

In the case of the *Conchylis* larvae the experiments were carried out from the beginning of September to the middle of October. The larvae were observed to be distinctly polyphagous, even devouring Euphorbiaceous plants. It will therefore be difficult to prevent the larvae from feeding on the first buds and fruits by means of disagreeable substances. They are also ready to devour the parts of the plant (e. g. the tips of shoots and young leaves, etc.) that are not generally found to be attacked.

The experiments with *Polychrosis* larvae were carried out in the spring and the larvae were found to be equally polyphagous.

These experiments show that: 1) these pests may continue to feed on the shoots of the vine, or failing this, on common weeds, so that measures for the control of the pest by the immediate consumption of the fruit attacked, are not adequate; 2) enclosing the bunches of grapes in bags serves to protect the fruit, but does not decrease the danger of the spread of the insects; 3) brushing the first shoots showing signs of attack is not effective in destroying the larvae, since they find shelter elsewhere, and further this procedure is liable to cause damage to the young vine shoots.

MEANS OF
PREVENTION
AND CONTROL

- 585 - *Thripoctenus brui* n. sp., a Chalcid Parasite of *Frankliniella robusta*, injurious to Peas in France. — VUILLET, A. in *Comptes rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVI, No. 13, pp. 552-555, figs. 1-3. Paris, April 10, 1914.

Garden peas are sometimes seriously damaged by attacks of the pea thrips (*Frankliniella robusta*), which, in 1913, caused considerable damage

near Montargis (Loiret). The writer describes a hymenopterous parasite of this insect, which is new to Science, under the name of *Thripocernus brui*. The description is based on numerous specimens occurring among the larvae and nymphs of *F. robusta* in the flowers of peas, broad beans and sweet peas collected at Dercy (Aisne) in July 1913. *T. brui* is clearly distinguished by several characters from *T. russelli* Crawford, the only other known species of the genus, parasitic on the bean thrips (*Heliothrips fasciatus* Pergande) in the United States.

The writer received a large number of specimens of *F. robusta* from near Montargis in 1913, but found no specimens of the parasite which was so abundant at Dercy during the same season. It would appear useful to distribute the flowers of peas and beans containing *T. brui* with a view to controlling the spread of *S. robusta* in the same way that Del Guercio (1) has controlled the olive thrips (*Phloeothrips oleae* Costa) by means of *Tetrastichus gentilei*.

586 - Destruction of *Conchylis* Larvae by Ladybirds. — LÜSTNER, GUSTAV in *Zeitschrift für Weinbau und Weinhandlung*, Year 1, Part 2, pp. 65-69, Berlin, 1914.

The writer has observed that the larvae of the first generation of *Conchylis ambiguella* Hub. are devoured by the adult *Coccinella septempunctata* when aphids are lacking. They are not attacked by the larvae of *C. septempunctata* and only to a slight extent by the adult *C. decempunctata*. When protected by their silky web they are not attacked by any *Coccinella*.

587 - The Destruction of Woolly Aphis (*Schizoneura lanigera*) and Pear Scale (*Epidiaspis betulae*) by Fumigation with Hydrocyanic Acid. — LÜSTNER, GUSTAV in *Deutsche Obstbauzeitung*, Part 8, pp. 174-176, 1 fig., Stuttgart, April 15, 1914.

Hydrocyanic acid fumigation has long been employed in America, but was introduced into Germany by the writer. Attempts to fumigate apple and pear trees to destroy *Schizoneura lanigera* and *Epidiaspis betulae* (= *E. pyricola*) have not met with success, and the expense is so great as to make the method impracticable for the treatment of fruit trees.

588 - The Chinch Bug (*Blissus leucopterus*), injurious to Cereals in Kansas. — HEADLEE, THOMAS J. and MC. COLLOCH, JAMES WALKER, in *Kansas State Agricultural College, Agricultural Experiment Station, Bulletin No. 191*, pp. 285-353, figs. 1-13, plates I-VII. Manhattan, Kansas, 1913.

The chinch bug existed in Kansas before the country was colonised. It hibernates on bunch grass (*Andropogon scoparius* Michx.), big bluestem (*A. furcatus* Muhl.) and false red-top (*Triplasis purpurea* Walt.), from which it migrates in early spring to wheat and other cereals. The first generation reaches maturity just after harvest, and finding itself short of food, it migrates to adjacent crops of maize and sorghum, where the second generation reaches maturity in the autumn. The insect then hibernates on waste grasses.

The larvae as well as the adults damage their host plants by piercing

INSECTS
INJURIOUS
TO VARIOUS
CROPS

(1) See No. 3027, B. Aug.-Sept.-Oct. 1911.

(Ed.).

the cortex, extracting the sap and destroying the tissues adjacent to the wound. The damage to crops in Kansas amounts to several million dollars annually, owing to the reduction in the yield of wheat and sometimes complete destruction of the maize and sorghum crops.

Dry seasons are particularly favourable to the development of this pest. Moist weather effectively destroys it by burying the eggs and larvae and by exposing the adults to the attacks of the fungus *Sporotrichum globuliferum* Speg., which is the only natural parasite of this insect. This fungus is widely spread throughout the regions affected by the pest, and when conditions are favourable it becomes a powerful epidemic. The most favourable conditions are a temperature of 24° C. and humidity approaching saturation.

Careful experiments have shown that it is not possible to spread the infection of the fungus by artificial means, and much money has been uselessly expended in adopting this method of control in Kansas. The most precise experiments have shown that destructive measures can be successfully applied twice a year, viz. during the migration of the first generation from the cereal crop to maize and sorghum, and again after hibernating. The writers have found that firing the winter quarters of the insect is the most economical and practical method of destroying it.

589 - *Tomaspis flavilatera*, n. sp. (Hemiptera) on Sugar Cane in British Guiana (1). — URICH, F. W. in *Bulletin of Entomological Research*, Vol. V, Part I, p. 43, figs. 1-2, London, April 1914.

The writer gives a technical description of a new froghopper, *Tomaspis flavilatera* (fam. Cercopidae), occurring on herbaceous plants and occasionally on sugar cane in British Guiana.

590 - *Polychrosis botrana* and *Conchylis ambiguella* in Piedmont in 1913: Biology and Control. — VOGLINO, P. in *Osservatorio consorziale di Filopatologia in Torino. Osservazioni sulle tignole della vite eseguite nel Piemonte nel 1913*, pp. 35, Turin, 1914.

As the result of a conference between the Agricultural Committee of Turin and the Subalpine Vine-growers' Society, held on February 22, 1913, a Commission was appointed to study the means of controlling the ravages of vine moths and to determine the value of tobacco extract for this purpose. The Commission met on the 1st of March and decided to appeal to local bodies and to the Ministry of Agriculture for financial help; the carrying out of the experimental work was entrusted to the Turin Phytopathological Observatory. (2).

Towards the end of April, measures were taken for the establishment of special stations for observation in various districts of the provinces of Turin (Moncalieri, Rivoli, Caluso), of Cuneo (Alba, Dogliani, Barolo), of Alessandria (Cassine, Mongardino) and of Novara (Briona). These

(1) See No. 352, *B.* Jan. 1911; No. 649, *B.* Feb. 1911; Nos. 1558 and 1584, *B.* May 1911; No. 1608, *B.* Dec. 1912; No. 1306, *B.* Nov. 1913, and No. 188, *B.* Feb. 1914. (Ed.).

(2) See article in *B.* July 1913, pp. 1000-1005.

(Ed.).

stations were definitely established at the end of April and beginning of May. At each station one or two vines were planted in wire-netting cages, and a small meteorological observatory was erected. With a view to regulating the observations of the different stations, a special scheme of questions was drawn up, and a practical and scientific control was effected by means of special control cages of very fine wire-netting for rearing the insects, at the Observatory at Turin; periodic visits were made to the various stations and important vine-growing districts. Observations were also made in districts without special stations as follows: Acqui (province of Alessandria), Gattinara (province of Novara) and the Susa valley (province of Turin).

The results obtained in 1913 show that in Piedmont *Polychrosis* is more widely distributed than *Conchylis*; the latter was occasionally numerous (50-80 per cent.) in colder districts at the mouths of the mountain valleys (province of Turin), and was also frequent (50-65 per cent.) at Gattinara. In the true vine-growing districts exposed to the sun, in the provinces of Turin, Alessandria and Cuneo, *Conchylis* was found in proportions varying from 2 to 4 per cent., exceptionally 10 per cent.: the larvae and moths found were largely *Polychrosis*.

The development of *Polychrosis* is in direct relation to the humidity of the air, being favoured by damp; abnormal changes of temperature in the spring, which have an injurious effect on the growth of the vines, have little effect on the development of the insect. The damage was caused by the spring and summer generations; the autumn generation consisted of a limited number of moths, only occurring locally, which did not produce larvae until after the vintage was mostly finished.

The spring emergence of moths occurred throughout May both in the laboratory at Turin and at the several stations; in one station only (Rivoli) they continued to appear until the beginning of June, with a maximum during the second ten days of May. They lived from 13 to 15 days and deposited their eggs on the stalks of the bunches and the pedicels of the flowers, especially in the second half of May, but also in the first week in June. The larvae of the first generation appeared towards the end of May and pupated from the second ten-days of June until July.

The summer generation of moths first appeared at the Observatory station on the 26th of June, and at the Stations during the first few days of July, with a maximum emergence during the second ten days (14th to 22nd); they lived 11 to 14 days and began depositing eggs on the grapes about the 15th of July, continuing into early August. The larvae of the second generation appeared during the third ten-days of July and especially in August and began pupating at the end of August.

The autumn brood of moths only appeared in certain districts (Monfardino, Dogliani, Barolo), from the 17th to the 22nd of September, shortly after the vintage. Only at Barolo was there supposed to be a third generation of larvae on the Nebiolo vine.

The season 1913 was not favourable to a biological study of *Polychrosis*, owing to the low humidity of the atmosphere, and the late spring frosts.

which in many places retarded the development of the shoots, thus depriving the moths of suitable places for depositing their eggs. Further researches are necessary to complete the biological study, especially with regard to pairing, oviposition, development of larvae of the second generation and the resistance of the pupae to insecticides and extreme temperatures.

The mode of cultivation has considerable influence on the development and spread of the pest. Where the canes or wooden supports are replaced by iron, sandstone or reinforced concrete, the number of insects is considerably reduced.

The programme for 1914 does not require an increase in the number of stations but an extension of regular and careful observations and the use of small cages made of fine wire netting and a sheet of mica. A certain number of pupae should be introduced into the cages in the spring and summer periods. By suspending these cages along the rows, it is easy to observe the first appearance of the moths and thus to regulate the application of insecticides. Cages are preferable to lamp-traps, since *Polychrosis* only flies at dusk.

Tobacco extract caused scorching in some places when used in 3 per cent. solution, but rarely in 2.5 per cent. solution, though combined with Bordeaux mixture; a concentration of 2 to 2.5 per cent. was found to be most appropriate. It was not always effective in keeping the moths away from the vines, and in some places was hardly satisfactory for destroying the larvae, though in others two applications during the period indicated by the flight of the adults were completely effective. The addition of sodium carbonate (1 lb. in 100 gallons) to the tobacco extract (without Bordeaux mixture) increased its efficiency; an intermittent jet should be used.

Tobacco dust damaged the vines in only two places, but was entirely without effect against the larvae.

Lead arsenate in 1 per cent. solution gave good results, combined with Bordeaux mixture, or used for dipping the young bunches.

The best results are obtained by employing arsenate of lead to destroy the first generation larvae, at least until tobacco extract can be obtained with a guaranteed nicotine content so as to avoid danger of damaging the young shoots. During July and August it is preferable to use tobacco extract (2 to 2.5 per cent.), since it acts as an insectifuge and avoids the difficulties of arsenate. The treatment should not continue later than the first few days of August, owing to the danger of affecting the flavour of the wine. In spraying, care should be taken to cover the neighbouring shoots with the liquid, since the moths kept away from the bunches would otherwise deposit their eggs on the leaves, and the larvae might reach the bunches.

In 1914 attention should be paid to clearing the vine stocks and removing hiding-places suitable for the hibernation of the pupae. On small holdings it would be useful to resort to hand picking of the larvae, without neglecting the use of insecticides.

The distribution of their natural enemies should be promoted by exposing during the winter badly attacked grapes in tubs covered with fine netting. Further, many pupae may be trapped by placing dark muslin or bunches of straw among the old wood of the vines.

591 - *Agromyza pruinosa* (Diptera) on River Birch (*Betula nigra*) in America. — GREENE, CHARLES T. in *Journal of Agricultural Research*, Vol. I, No. 6, pp. 471-474, plates LX-LXI. Washington, D.C., 1914.

The writer describes the different stages of development of *Agromyza pruinosa* Coq., the larva of which, unlike those of other species of *Agromyzidae*, bores into wood; this species produces borings, known as "pith ray flecks", in the cambium of the river birch (*Betula nigra*).

During July and part of August 1912 considerable damage was caused by this insect at Chain Bridge in the District of Columbia, whilst in 1913 it was only recorded on a few trees in this locality. The attacked trees appear quite healthy externally, the borings in the cambium being only visible on raising the bark.

The writer reared six adults of *A. pruinosa* during the spring of 1913 and found that it resembled very closely *A. carbonaria* Zett. which causes considerable damage to birches in Europe. He records *Symphya agromyzae* Rohwer, as parasitic on the eggs of *A. pruinosa*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

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(b) Communicate to parties interested, also as promptly as possible, the above information.

(c) Indicate the wages paid for farm work.

(d) Make known new diseases of plants which may appear in any part of the world, showing the territories infected, the progress of the diseases, and, if possible, the remedies which are effective.

(e) Study questions concerning agricultural co-operation, insurance and credit in all their aspects; collect and publish information which might be useful in the various countries for the organisation of work connected with agricultural co-operation, insurance and credit.

(f) Submit to the approval of the Governments, if there is occasion for it, measures for the protection of the common interests of farmers and for the improvement of their condition, after having utilized all the necessary sources of information, such as the wishes expressed by international or other agricultural congresses, or by congresses of sciences applied to agriculture or agricultural societies, academies, learned bodies, etc.

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FIRST PART.
ORIGINAL ARTICLES

Root-Nodosities of Crosses between Swedes and Turnips

by

L. HELWEG

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The Danish Experimental Organization for Crops (1) has undertaken fairly exhaustive researches on crosses between swedes and turnips and the nodosities occurring on their roots. A short account of the information obtained may well be of general interest.

As is well known, swedes are derived from rape (*Brassica Napus*) and turnips from *Brassica campestris* (2). No nodosities form on the roots of crosses between two *Napus*-forms or two *campestris*-forms, but they occur when a *Napus*-form is crossed with a *campestris*-form, whichever be the female parent. If, for instance, the Bullock turnip is crossed with the Shepherd swede the offspring bear nodosities on their roots; but when Bullock is crossed with a summer *campestris*-rape or Shepherd with a summer *Napus*-rape, no such formations occur, although Bullock and Shepherd are much more alike than *campestris*-rape and *Napus* rape. Both Bullock and Shepherd have round, thick, yellow-fleshed, green-topped roots; they are biennials with orange-yellow flowers. The two kinds of summer rape both have forked, woody and not fleshy, white roots, and are annuals with lemon-yellow flowers. Anyone not specially acquainted with the subject would be much more likely to expect root nodosities when such dissimilar plants as Bullock and *campestris*-rape or Shepherd and *Napus*-rape were crossed than when Bullock was crossed with Shepherd.

Notwithstanding the outward similarity of Bullock and Shepherd, there must be a decided inner difference between them, to judge by the antipathy exhibited in their sexual union; they show this by the appearance

(1) See article: « Organization of Field Experiments in Denmark, » by H. C. LARSEN, in B. Oct. 1913, pp. 1479-1483. (Ed.).

(2) There seems to be no English name to distinguish the *campestris*-rape (rübsen) from the *Napus*-rape (raps), so that the Latin names will be used here. (Ed.).

of the monstrous growths which we call "nodosities due to crossing" (Kreuzungsknoten).

The nodosities are of various forms according as the hybrid in question is rape-like, swede-like or turnip-like; they therefore merit separate description.

1) In the *rape-like hybrids* the nodosities are quite small, but are so closely crowded along the branches of the roots that they appear almost as swellings with small transverse wrinkles and folds reaching the whole length of the root (see Fig. 1). Occasionally hemispherical nodosities occur; these have the flat face towards the fork of the root (see Fig. 1, right). In rape-like hybrids the swellings predominate, nodosities, when present, being of secondary importance.

2) The *swede-like hybrids* are characterised by the size and abundance of the nodosities and the slight development of swellings. The nodosities occur on the bulb and on the fibrous roots, and vary from the size of hen's eggs to that of peas (Fig. 2, A); exceptionally, they may reach 4 to 6 in. in diameter (Fig. 2, B), and even form clusters, thus giving the bulb a more or less misshapen appearance (Fig. 2, C). The nodosities of these swede-like hybrids differ from those of the rape-like and turnip-like hybrids in being sharply defined and generally only joined to the bulb (Fig. 2, B) or the rootlet (Fig. 2, A) by small areas of union. The surface of the nodosities is very much wrinkled and uneven, something like the top of a cauliflower.

The rule mentioned above, that in swede-like hybrids nodosities are more abundant and swellings less so than in rape-like hybrids, is not true under all circumstances. The opposite is especially liable to occur in swede-like hybrids when the bulbs are unable to develop owing to the plants growing too thickly, to very late sowing or to other similar causes. Thus, when conditions prevent the formation of the bulb, the swede-like hybrid resembles the rape-like one (Fig. 1) in its root-characters.

3) In *turnip-like hybrids* the nodosities generally appear as characteristic tumour-like bunches on the bulb itself (cf. Fig. 3, D, and Fig. 4, B and A) and are attached to it by large surfaces; they never occur on the fibrous roots. They are not wrinkled like those of the rape-like and turnip-like hybrids, but quite smooth and sometimes shining (Fig. 3, A and B).

As is shown in Fig. 3, A, large clusters of nodosities may occur in turnip-like as in swede-like hybrids (cf. Fig. 2, C). It will also be noted that the turnip-like hybrids are not behind the swede-like ones as regards the size of the nodosities; but they may be quite small as in Fig. 3, C, in which the bulb might pass for a typical Yellow Tankard but for the small nodosity on the middle of the left side.

The swellings at the places where the roots branch are even more characteristic in turnip-like than in rape-like hybrids, but are by no means so abundant. The roots on which they occur are disproportionately thickened throughout their whole length (see Fig. 4, C); as in the rape-like hybrids these swollen parts are transversely furrowed. Sometimes these swollen side-roots are double (Fig. 4, C), apparently owing to the union of two rootlets throughout their length,

Among the turnip-like hybrids it is not uncommon to find plants like D in Fig. 4, in which the bulb has hardly developed at all, but is replaced by a number of short, much-swollen side roots.

Further attention should be drawn to the fact that turnip-like hybrids never produce a feature occasionally seen in the other two types, namely the occurrence of a certain number of adventitious shoots bearing rudimentary leaves arising from on or among the nodosities (see Fig. 5 and Fig. 2, D). Such shoots remain below ground and are consequently chlorotic throughout, unless they arise from roots at a very slight depth, when they may project to a maximum of 4 or 5 inches and become green.

As these nodosities occurring on hybrid swedes and turnips are liable to confusion with those caused by the finger-and-toe organism (*Plasmodiophora Brassicae*), it may be well to describe briefly the means of distinguishing them. Fig. 6 shows on the left three plants of Fynische Bortfelder and on the right three of Bangholm's. The distinguishing characters of finger-and-toe disease are evident under the microscope, and in doubtful cases one may be obliged to have recourse to this method; but as a rule a little practice serves to distinguish the two without difficulty. The first thing to be noted is the presence of characteristic spindle-shaped swellings on the side roots (see Fig. 6, A, B and C). In general shape they may somewhat resemble the swellings on the roots of turnip-like hybrids (cf. Fig. 4, C), but cannot be confused with them, as the surface of the finger-and-toe swellings is smooth and they never show the closely-placed constrictions so characteristic of the swellings on the roots of the hybrids. Though these swellings do not occur on every diseased root, they are sure to be found among a number of roots taken from a field where finger-and-toe is prevalent. Another distinguishing feature of the finger and-toe swellings is that they often show the beginning of cork formation on the upper part; this never takes place on the nodosities of hybrids. On the larger finger-and-toe swellings a considerable development of rough greyish-brown cork generally takes place; the dark central part of Fig. 6, E, is a cork layer of this nature. Attention should also be drawn to the swellings near the tip of the root in Fig. 6, F; a swelling in that position fairly frequently occurs in both swedes and turnips attacked by the disease. In this case it differs from the nodosities of hybrids in narrowing equally above and below. Finally, a special characteristic of the deformed parts of roots attacked by finger-and-toe disease is the almost invariable presence of irregular brown streaks in the flesh, as may be readily seen on cutting the swellings across; such streaks never occur in the nodosities or swellings due to hybridisation.

The elucidation of these points has been of considerable importance for the seed trade. To this work is due the fact that in the season 1913-14 the wholesale dealers in turnip seed were able to undertake to guarantee the trueness to variety and strain of the Danish swede and turnip seeds sold abroad, in conformity with the law of the 8th of June 1912 on penalties for erroneous designation of goods. This law gives the foreign purchaser the right to full compensation in case the crop grown from the Danish swede or turnip seeds contains so many hybrids or degenerated roots that the yield

is distinctly reduced. The fact that the Danish wholesale seedsmen have been able to assume without risk such a comprehensive liability for compensation is due to the demonstration by the Experimental Organization of the certain characters by which swede and turnip hybrids can be recognized. In careful selection of Danish strains of swedes and turnips carried out for a number of years, the seedsmen have thus been in a position to undertake such a thorough elimination of all plants tending to degeneracy that the stability of the strains may now be considered as thoroughly established.

Present State of Fruit Growing in Spain. (I) (The Principal Fruit Trees of the Rosaceae).

by

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Almost all the fruit trees grown in the different parts of the world grow in the open in Spain; from the chestnut woods which cover the northern slopes of the Cantabro-Asturian mountains to the plantations of bananas and guavas which adorn the orchards of Malaga and Cadiz, almost all kinds of fruit trees are well represented.

Limiting ourselves to the most widespread fruit trees, we shall consider pear and apple among hard fruit, and peach, apricot, plum and cherry among stone fruit.

Conditions and importance of fruit growing in Spain. — The Iberian Peninsula, covering seven degrees of latitude from the Straits of Gibraltar to the Cantabrian coast, and possessing various conditions of altitude, aspect, soil and geological formation, is very favourable for the growing of the above fruit. Indeed fruit is grown in all the 47 provinces on the mainland, and in some districts, such as Aragon and Rioja, it forms one of the chief sources of wealth.

The progress of fruit growing in Spain has been slow, on account of the former slowness and insufficiency of the means of transport. The development of the railways led to the spread of the use of fruit among all classes and to the extension of the plantations, though not to the same extent as in some other countries, nor in all the districts suitable for fruit.

Only meagre data on the fruit plantations of Spain and their production are available. According to the "Avance estadístico de la producción de frutales en 1910," (Statistics of the production of fruit in 1910), published by the General Direction of Agriculture, Industry and Commerce, the total area under the above-mentioned kinds of fruit is 121 526 acres, distributed as shown in Table I.

(1) See also: JUAN M. PRIEGO, "The Present Condition of Citrus Growing in Spain", — B. Feb. 1913, pp. 162-167.



Fig. 1. — Swellings and nodosities of tape-like hybrids.

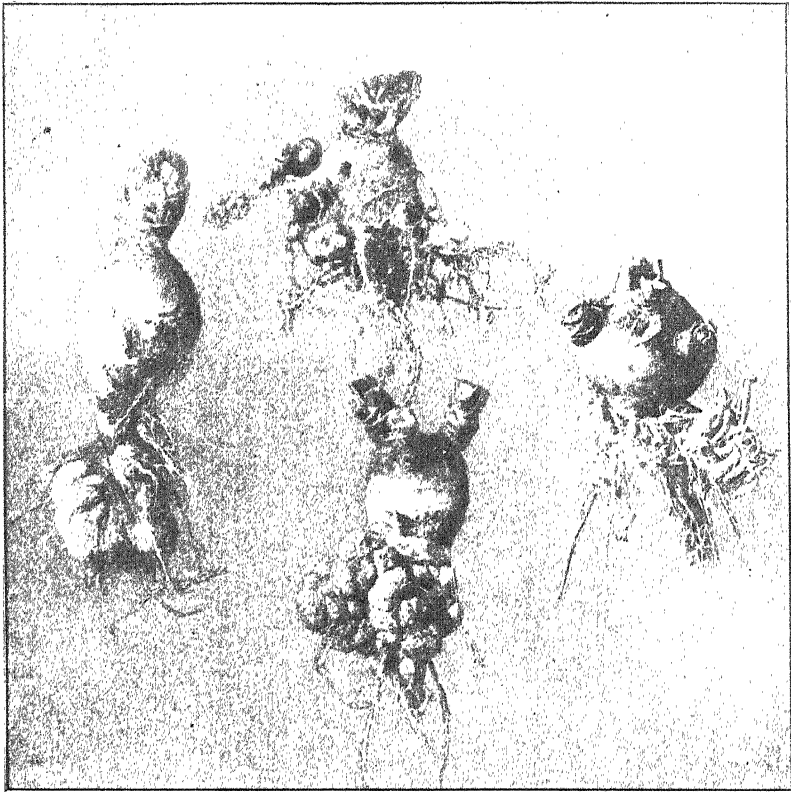


Fig. 2. — Nodosities on roots of Swede-like hybrids.

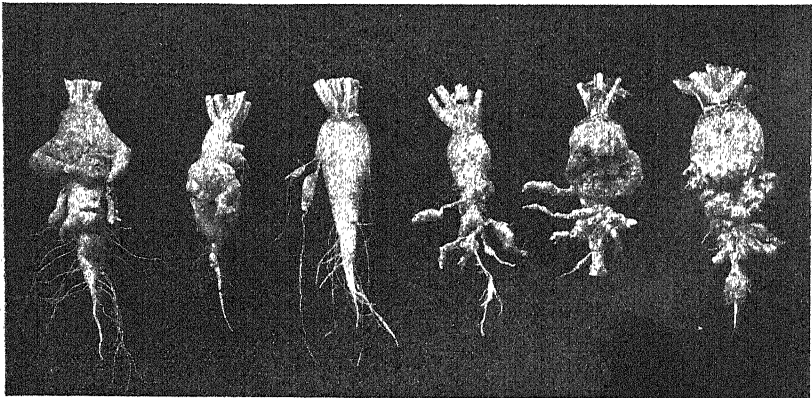
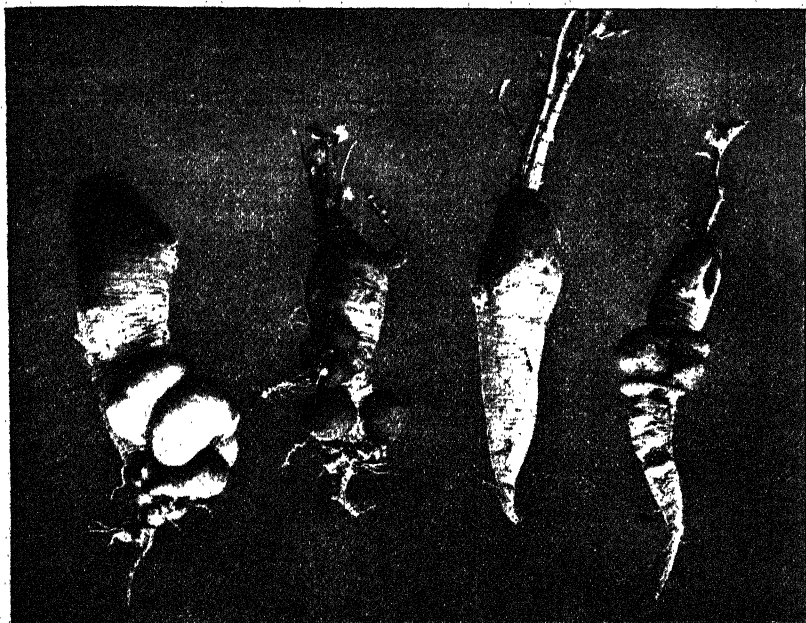


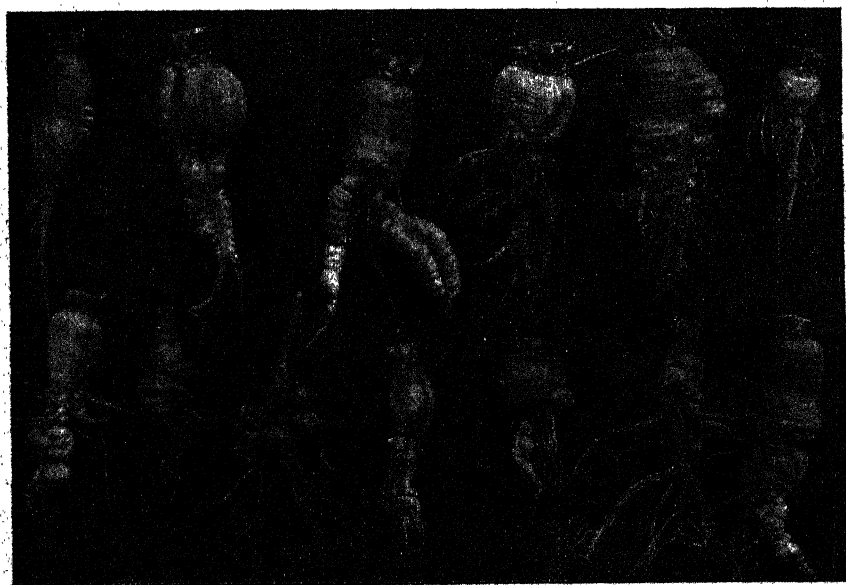
Fig. 6. — Swedes and turnips attacked by *Plasmodiophora Brassicae*.



A B C D

Fig. 3. — Nodosities on roots of turnip-like hybrids.

C B



D

A

Fig. 4. — Swellings and nodosities of Turnip-like hybrids.

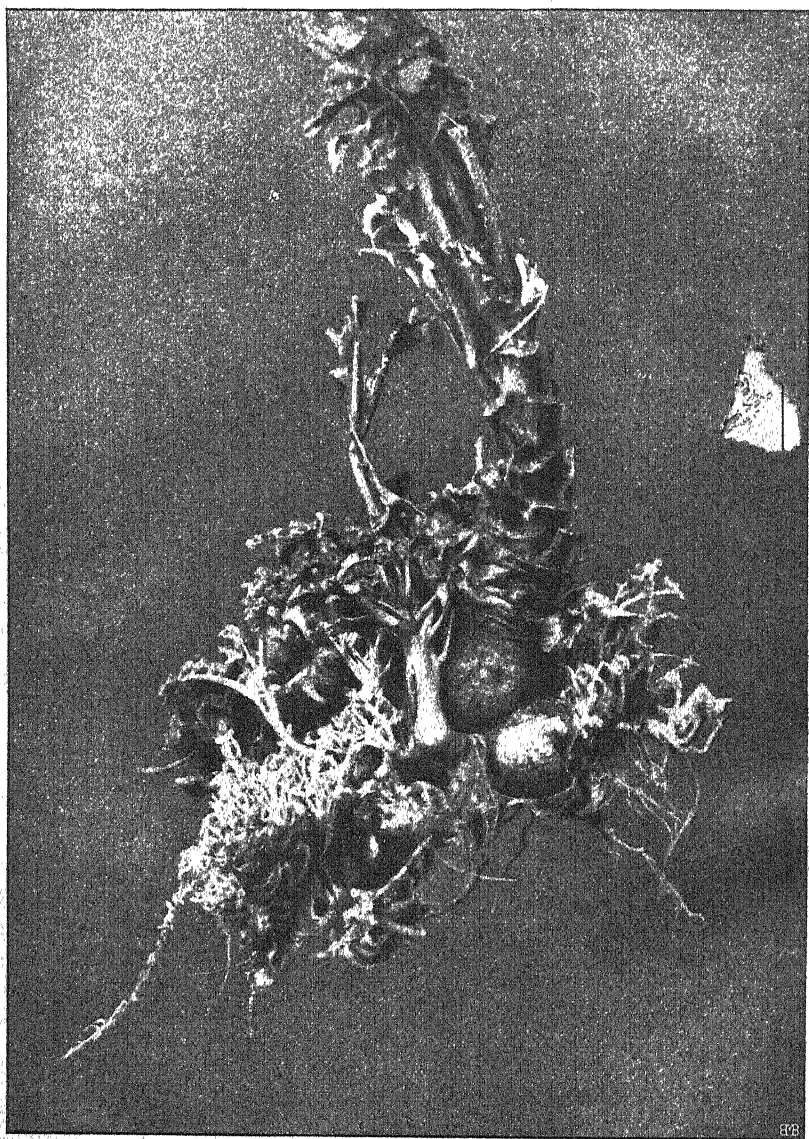


Fig. 5. — Adventitious shoots on a rape-like hybrid.

TABLE I.

Acreage under hard and stone fruit in the various regions of Spain.

	Acreage under					
	Plums	Apricots	Peaches	Cherries	Pears	Apples
New Castile	1 163	479	329	739	1 050	1 055
Mancha and Estremadura . .	630	472	615	151	874	719
Old Castile	2 339	412	398	1 121	3 441	3 300
Aragon and Rioja	1 880	595	3 372	734	4 707	2 702
Leonesa	472	368	183	978	415	736
Galicia and Asturia	454	114	1 314	2 868	6 219	22 665
Navarre and Vascongadas . .	220	190	494	514	3 866	11 399
Catalonia	625	370	1 408	346	1 976	2 396
Levante	590	2 440	2 932	1 000	1 146	2 408
Eastern Andalusia	1 647	457	1 220	672	897	1 015
Western "	1 892	217	576	242	1 028	1 974
Balearic Isles	370	2 223	—	—	—	1 235
Canaries	99	123	173	—	642	442
Totals	12 382	8 462	13 012	9 364	26 261	52 045

The numbers in the Table are only approximate and leave out a large number of fruit trees scattered among other crops, or in gardens, vineyards and fields, since the precise valuation of the surface they occupy is very difficult.

The estimate of the amount of fruit produced is also below the reality. The fruit crop of 1910 was bad almost all over the country, owing to late frosts and summer drought. The 300 000 tons to which such produce approximately amounts, valued at the average price of 15 pesetas per quintal (11s 10 $\frac{1}{2}$ d per cwt.), which was the price adopted by the Commission appointed for the study of the transformation of the tax on consumption, give a value of nearly £ 1 800 000. In the work of the above Commission the value of the average crop of the fruit here considered was taken at £ 1 920 000, being based on older data as to the acreage under fruit.

The exportation is of no great importance, as may be seen from Table II.

If the data concerning the acreage under fruit trees, the yield and the exportation be compared with those of other countries under conditions similar to those of Spain, it will be seen that the latter is still far from having taken full advantage of its favourable conditions. Nevertheless its production is increasing, though not so rapidly as that of some other crops for which the country is less suitable. The land not devoted to field crops, such as much of that which is still uncultivated and a great part of the vineyards

TABLE II.
Exportation of hard and stone fruit from Spain, 1907-11.

	1907	1908	1909	1910	1911
	£	£	£	£	£
Apricots	2 338	200	478	3 832	1 261
Peaches	5 293	1 537	2 290	1 116	1 829
Apples	19 641	4 808	15 006	3 649	6 507
Plums	2 861	1 464	4 901	10 412	9 723
Other fresh fruit.	25 578	24 089	30 757	27 795	23 843
Fruit pulp	36 841	32 330	37 533	63 298	60 142
Totals	152 552	64 428	90 965	110 102	103 310

destroyed by phylloxera, is eminently suitable to fruit growing. The markets of the country are far from being amply provided, considering that the average amount consumed by the population is about 40 lbs., worth 2s 1½d, per head per annum. Whole districts consider fruit as an article of luxury. The exportation of fruits is stationary and very limited; England, Germany, Denmark, Sweden and Russia hardly know the pears and peaches of Aragon, Rioja and Lerida, the apricots of the Balearic Isles, Castellón and Murcia, and the cherries of Lugo, Orense, etc. France, whose consumption of fruit per head of population is four times that of Spain, exports fruit to the value of half a million sterling every year, and Belgium, which is inferior in extent to two Spanish provinces, reaches nearly the same figure.

Distribution of fruit in Spain.— Though fruit growing has not the same importance in all the provinces, in all of them fruit trees are grown. The various species are distributed as follows:

Hard fruit.— Pears and apples are cultivated almost throughout Spain. Table varieties have little or no importance in seven provinces, *viz.* Leon, Cuenca, Malaga, Huelva, Valladolid, Guadalajara and Seville.

The most important plantations of *pears* are those of Aragon (basins of the Ebro, Jalon, Jiloca and Guadalopec), Castellón de la Plana, Burgos (districts of Aranda), Galicia (Pontevedra, Orense and Lugo), the mountainous districts of Andalusia, the Sierra de Córdoba and the territories of Baza and Guadix in the province of Granada. The first belt produces not less than 20 000 tons in average years; the pears are of such excellent quality that the Royal Household obtains its supplies from here. The varieties most extensively grown are Sanjuaneras, Deagua, D. Guindo, Bergamotas, and Roma; these and some winter ones are exported in ever-increasing quantities into the South of France.

The area under dessert *apples* is very nearly the same as the above described area. These apples, however, prevail in the Lerida district, extending also into the province of Gerona, in the Levante district, where the summer and early autumn varieties thrive very well, and in the province of Cordoba (Cordoba, Baena and Cabra).

The cider varieties of both species cover the northern slopes of the Cantabrian mountains in the provinces of Navarre, Guipuzcoa, Biscay, Santander and Oviedo, and the slopes and valleys near the coast in the territory of Pontevedra and Lugo (Galicia). The province of Oviedo is the greatest producer of cider. The total crop of all this belt is from 8 to 11 million bushels of cider apples.

Stone fruit. — The most important stone fruit is the *peach*, both for the acreage devoted to it and for the value of the fruit produced. It is grown in 40 provinces, but its produce is really important only in those of Saragossa, Teruel, Logroño, Lerida, Barcelona, Orense, Murcia, Jaén and Castellón. The first four provinces form a belt in the basin of the Ebro and its tributaries, producing an average of about 4000 tons of excellent quality. The free-stone and Pavia peaches of Lerida, the clingstones of Sástago and Escatrón, the yellow peaches of Campiel, and the large peaches of Saragossa are equal or superior to the most esteemed of other countries and supply Madrid, Barcelona, etc., during the season, following the earlier ones from Castellón, Valencia and Murcia. Of all these peaches a certain proportion is exported to Paris, London and Hamburg.

The southern belt of the province of Madrid and its valleys of the Tagus and the Tajuña are rich in various fruits, including productive and highly esteemed peaches and plums. Its principal centre of production is Aranjuez which supplies a good deal of the fruit consumed in Madrid.

Under the form of "orejones" (peaches halved and dried), great quantities of the crop are prepared and preserved, as it would be difficult to export them fresh to great distances. The dried peaches of Malaga and Logroño are held in high esteem everywhere.

In point of importance the *plum* follows the peach. It is more regularly distributed, thanks to the greater resistance of its fruit to bad weather. Toledo, Granada, Almeria and Lerida rival Aragon in the production of plums. Greengages are, to a certain extent, exported to Paris and other capitals. In the Llobregat territory, plums are grown with apricots. They are also widely spread in the above-mentioned belt of the province of Córdoba, whence they are also exported to a certain extent. This productive tree, so reliable in its yield and having the advantage of producing fruit easily dried or preserved, deserves to be held in still greater consideration than it is.

Apricots, which are the most exacting as to climate of all the species here mentioned, naturally occupy the most limited area. At the same time they are grown in 36 of the provinces of Spain and are totally wanting only in the North and in a part of the North-west of the peninsula and in some provinces of Western Andalusia. The apricots of Toledo are distinguished by their keeping quality and resistance to carriage, due to the fact that they acquire a pleasant taste before they are quite ripe. The apricots of Levante are large, tasty and early. In Murcia they form part of the early produce exported to Central Europe. In the Balearic Islands they occupy about 2500 acres and give rise to an important export trade of fresh fruit and pulp for preserves; indeed they constitute the most valuable crop.

Egriots, morellos and cherries have been abandoned in a number of provinces; the central plateau of the two Castiles and the provinces of Salamanca, Lugo, Orense, Lerida and Castellón are the greatest producers of these fruits. Those grown along the Segre and the Cinca are profitably exported. The still earlier cherries of Sagunto and the Segures valley are packed in small boxes and sent to Paris. The large cherries, such as the Costalera, Corazón de Cabrito and some others with very firm flesh, being suited to extensive farming and possessing great resistance and keeping qualities, are especially advisable in the large bare plains and in the small ranges of Tertiary calcareous rocks so frequent in Spain.

Observations on cultural methods in Spain. — In almost all the above mentioned districts fruit trees are intermingled with other crops, chiefly in market gardens. In some districts, especially the Basque provinces, fruit trees are planted on grain land or pasture; in some parts of Aragon and Levante they are grown in vineyards; less frequently, as in the Toro neighbourhood, they form pure plantations.

The drawbacks of intermingled crops, especially of trees with field crops, are well known. The former cast an injurious shade on the latter and these in their turn take up much moisture and plant food from the soil. Manures to suit all the different plants cannot be prepared, and the operations of tillage and irrigation do not always coincide. This interplanting of fruit trees with other crops, which is so frequent in Spain is, we believe, one of the chief causes of the fact that fruit growing is not so profitable as it might be. The farmer devotes more care to the garden crops, the cultivation of which he generally knows better, whilst he is ignorant of the practice of treating and pruning the fruit trees.

In these various types of fruit plantations the different kinds of trees are generally mixed together. But besides these plantations there are many scattered trees, chiefly apricots and plums, in either enclosed or open fields.

Economic data. — Yield of fruit trees in Spain. — If the returns of fruit growing were to be estimated upon the figures supplied by the "Avance" of the General Direction of Agriculture, to which we have already referred, the conclusions would not be very favourable. The figures are the following:

	Yield per acre
	cwt.
Pears	51
Apples	58
Peaches	30
Plums	43
Apricots	40
Cherries	40

But, as we have already said, the 1910 crop was generally bad and these yields are certainly inferior to the average. The data collected by us in the chief producing centres are the following:

Pears. — Standard pears begin to produce at the age of 15 years. When in full bearing they yield about 1 cwt. of fruit per tree. The value

of this fruit varies, like that of all other kinds, with the variety and the season. Those produced in Aragon, sold on the spot under normal conditions, may be valued at 8s per cwt. A certain proportion of the good autumn and winter varieties are exported and fetch more than double the above price. In the province of Saragossa the variety most esteemed for exportation is the De Roma. In a regular plantation in rows about 100 pear trees are grown to the acre; they yield about 5 tons of fruit, worth about £40.

Apples. — The bearing and yield of apples vary still more than in the case of pears. We believe that the figures of the above "Avance" may be taken as correct for average years. The apples supplied to the Madrid market come for the most part from the Valenza and Teruel districts, where their price ranges between 6s and 12s per cwt.

Peaches. — Peach trees begin to bear at the age of four or five years. Their average yield may be taken at 44 lbs., and as in one acre there are about 120 trees, the yield per acre is about 47 cwt. of fruit; in normal seasons this is worth, at the orchard, never less than 12s per cwt., the gross returns being thus about £28 per acre. Peaches are the most esteemed fruit, even in the home market; especially choice and early fruit fetches high prices. They are frequently sold by the dozen, and on the spot where they are grown the large peaches of Saragossa and Lerida, or early or late varieties, command as much as 1s 7d per doz. The peaches of the Segre, Cinca and Llobregat valleys supply Barcelona, and some are shipped from that port. A certain amount of exportation takes place from Castellón de la Plana. The peaches of Saragossa, Teruel and Rioja are consumed in the interior or used in the local preserve factories.

Plums. — This tree is grown almost always as a standard and develops well in the whole of Spain, producing, when fully grown, as much as 130 lbs. of fruit per tree. Of all the fruit trees it is the one least frequently grown by itself. The price of its fruit varies very much; its dimensions, form, colour, taste and keeping qualities (the latter never being high) also differ largely in the different varieties. In years of abundance their price falls as low as 2s 5d per cwt. Greengages, when well packed, are worth eight or ten times as much on the great markets.

Señor GAJON, a well-known fruit grower of Saragossa, calculates the yield of a plum tree as follows: 10d at the age of six years; 6s 4d at twelve years; 9s 6d at sixteen; 11s 10d to 15s 10d at twenty and upwards, always provided that the fruit be placed on a good market.

Apricots. — The yield of this tree, which is never very regular, may be valued at 132 lbs. per tree every other year. Reckoning 112 trees per acre (real distance apart about 20 feet), the average produce per acre per annum would be about 66 cwt., which, at a minimum price of about 10s per cwt., amounts to an average gross income of £33 per acre.

The plantations of Murcia, Aranjuez and Toledo supply the Madrid market; Castellón and the Llobregat valley that of Barcelona. These districts and Murcia export a good number of boxes. This fruit has acquired considerable importance in the island of Majorca, where it now occupies

about 2250 acres and is yearly extending. The apricot preserve exported every year from the Balearic Islands is valued at £24 000.

Cherries. — The produce of this tree, which is more reliable than that of the apricot, is estimated at 330 lbs. per tree; the fruit of good varieties sells at 8s to 12s per cwt. Where the cherry trees attain their full development not more than 40 can be planted to the acre, in which case the gross returns may be estimated at least at £40 per acre.

The first cherries to appear on the Paris market are from Spain. Unfortunately the number of boxes exported is limited, as the production barely keeps pace with the home consumption and it is difficult to understand why a fruit that is in such demand both at home and abroad is not more widely planted.

Cost of production. — The cost of producing fruit varies very much according to the locality and the systems of cultivation adopted; the difficulty of ascertaining such cost is greater when the fruit trees are interplanted with other crops. When they are grown by themselves, the cost of production is but little higher than that of growing olives. There is no doubt, however, that they leave the grower a satisfactory margin of profit and that fruit growing is destined to develop considerably in the near future.

The Dairy Industry in Italy at the Present Time

by

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STATISTICAL DATA ON MILK PRODUCTION.

No accurate and recent statistics on milk production in Italy are available, and the data given in the present paper have been obtained indirectly or are merely personal estimates. The last live stock census, taken in 1908 by order of the Department of Agriculture, forms a positive point of departure; from it are taken the following figures dealing with the classes of animals producing milk:

	Number of head
Sheep	11 162 926
Cattle	6 198 861
Goats	2 714 878
Buffaloes	19 366

The dairy industry depends chiefly on sheep and cattle. The scarcity of the bovine species, which is the more important in milk production, is quite evident both when the numbers are considered in relation to the number of inhabitants, or when compared to various other European states. With regard to the distribution of the cattle over the twelve regions of Italy,

more than half the total numbers, or 3 662 813 head, are found in the valley of the Po, and of these over one million are in Lombardy, where the density of cattle is at its maximum; Emilia, Veneto, Piedmont and Sardinia follow in the order given at no great distance apart. Lower Lombardy, which includes the fertile irrigated plains of Pavia, Milan, Cremona, Brescia, Mantova, is the zone of most intensive milk production. Owing to irrigation, four crops of hay may be obtained annually, and on the so-called "marcita" fields, near Milan and Pavia, the number rises to seven or eight. The quadrangle bounded by the rivers Ticino, Po and Adda and the parallel running through Milan is characterised by its dairy farming, the milk production per unit area or per head of the population being higher than in any other part of the world. Emilia too, in the provinces of Reggio, Parma and Modena, has made great strides since 1881 with regard to increasing the number of its cattle, its forage crops and its milk production, so that to-day the density of cattle for the whole region (Emilia) is higher than that of any other whole region in Italy, *viz.* 18.1 per square mile. In fact the number of cattle increased in all parts of Italy from 1881 to 1908, the total increase being almost one and a half million head, or about 30 per cent., and its quality has improved at the same time.

Sheep are most abundant in the southern Adriatic region, where about two million head are found, while the southern Mediterranean region, Sardinia, Latium, and Tuscany follow in order, having over a million head each. The density is highest in Latium. In a general way it may be said that the number of cattle per acre decreases going from north to south while on the contrary the number of sheep per acre increases. Goats abound in the southern Adriatic region but in no other parts. Buffaloes are pastured on swampy ground where no other domestic animal could live; herds are found in certain localities in Latium and in the southern parts of the country (Salerno, Caserta, Foggia, etc.)

As the 1908 census does not state the number of females which may be considered milking stock in each of the above classes of live stock, an approximate estimate must be made to arrive at the milk production in Italy. Assuming that the percentage of milking stock in the total registered be 60, 70, 55, and 50 for cattle, sheep, goats and buffaloes respectively, then the numbers of milking stock in Italy would be approximately as follows:

Cows	3 600 000	head
Sheep	7 800 000	"
Goats	1 500 000	"
Buffaloes.	10 000	"

It is not easy to calculate the average quantity of milk produced by the above stock, owing to the heterogeneousness of the breeds and to the dissimilarity of systems of management.

Cow's milk.— Leaving aside the question of breeds, there are two opposite systems of management of milch cows in Italy, *viz.*: permanent housing and free ranging. In the north, where milk is an important industrial

substance, the cows are housed permanently or almost permanently; this system is also in vogue in parts of Central Italy (Tuscany, Umbria), where however, the milk is chiefly used for calf rearing. Free ranging is met with in the central regions beginning in Latium, in the southern part of the country and in the islands, where the milk is partly employed for calf rearing and partly for cheese making on a small scale. In the latter case yields are small owing to the not infrequent scarcity of fodder and to the exposure of the cattle.

Where milk production is carried on intensively, as for instance in Lombardy, calves are usually removed from their mothers a few days after birth and almost the entire production of milk is available for cheese making. In the central regions, on the contrary, the cows are never milked, but merely suckle the calves, in which case the period of lactation is greatly reduced. An intermediate system exists in Sardinia, where it is usual to milk the cows once a day during a part of their lactation period, *i. e.* during April, May, June, and October.

To estimate the average production of milking cows in Italy, those which are only used for suckling calves and those which are only milked for a very brief period should be excluded, *i. e.* about 1 000 000 head, which reduces the number of milking cattle from 3 600 000 to 2 600 000. The average annual production per head varies from 25 hectolitres (550 gallons) in Lombardy to 10 hectolitres (220 gallons) for Alpine cattle and 4 hectolitres (90 gallons) for free ranging cattle in Sardinia, so that assuming an average production of 12 hectolitres (265 gallons) for the above 2 600 000 cows the estimate will be conservative. On this basis 31 200 000 hectolitres (7 million gallons approx.) would be produced annually, of which part is used for direct consumption and part is worked up into other dairy produce.

The population of Italy, consisting of 34 million inhabitants, consumes very little cow's milk, the consumption being highest in the northern provinces and least in the central and southern regions, where many Italians never drink cow's milk at all, partly because it is not customary to do so and the product is expensive, and partly because they use ewe's or goat's milk instead. The average consumption per head may be estimated at 18 litres (4 gallons) per annum, or 0.05 litre (0.1 pint) per day, which is a negligible quantity compared with the consumption in Germany, Denmark, Holland, Sweden and Norway. On this basis 6 120 000 hectolitres (150 million gallons) are consumed directly, leaving 25 080 000 hectolitres (550 million gallons) for the production of other dairy products.

Ewe's Milk. — The milk production of ewes varies from 100 litres (22 gallons) per annum in Sardinia to 40 litres (10 gallons) in some of the flocks on the mainland. Assuming a mean yield of 70 litres (15 gallons) per head per annum, the annual production of ewe's milk available for the dairy industry is 5 460 000 hectolitres (120 million gallons).

Goat's Milk. — Goats yield more milk per head than do ewes. In Sardinia their annual yield is estimated as 140 litres (30 gallons), but for present purposes 100 litres may be taken as the average figure per head

after deducting the amount required for raising the kids. This is equal to a total annual production of 1 500 000 hectolitres (33 million gallons).

Buffalo's Milk. — Milking buffaloes may yield from 5 to 8 hectolitres (100 to 180 gallons) per annum, but the semi-wild state in which they are kept causes their milk yield to vary considerably from year to year. For present purposes their yield may be estimated at 4.5 hectolitres (100 gallons), which gives a total annual production of 45 000 hectolitres (1 million gallons).

The following table summarises the data dealing with the milk production of the bovine and ovine species, this being not only the most important source of supply but also the one capable of eventual increase.

	Cattle	Sheep
Total numbers (1908 census)	6 198 861	11 162 926
Females	3 600 000	7 882 727
Milking animals.	2 600 000	7 800 000
Average yield per head galls.	265	15
Total annual production million galls.	700	120
Milk used for direct human consumption " "	150	—
Milk worked up industrially " "	550	120

It is important to emphasize the fact again that of the above figures, only those of the 1908 census are absolute, the others being the result of estimates.

UTILIZATION OF MILK.

Cow's milk. — This is put to three chief uses:

1. Condensation. — Carried out in two factories in Lombardy; only accounts for a very small proportion of the total produce. Milk powder is also prepared in small quantities.

2. Direct human consumption. — City dairies, which deal with this section of the industry, are to be found in the principal Italian cities, but even the most modern and up-to-date examples are very modest compared with the large establishments of this kind which exist in other countries, such as at Vienna and Berlin. Much improvement has taken place with regard to the handling of milk, but even now the greater part is sold by small local dealers. The retail price consequently varies with the abundance of the local production, and prices increase from North to South of the country, the minimum and maximum being 2d and 6 ½d a quart respectively. Of late years prices have tended to rise. The wholesale prices obtained in Lombardy and Emilia have risen gradually from 5d to 7.7d per gallon during the last ten years. In all the principal cities, the retail milk trade is subject to inspection by local hygiene officers.

3. Cheesemaking. — About five-sixths of the total milk production is turned into cheese, butter, and their bye-products. The factories dealing with this section of the industry may be grouped into three classes: private factories, where the producer of the milk turns it into cheese and butter

himself; industrial factories, such as exist in Lower Lombardy, where the milk is bought from the producers and worked up—as much as 4,400 gallons being dealt with per day; and cooperative factories, which are chiefly to be found in the Alpine districts, but which also exist in Emilia, while a few isolated examples may be found in Sardinia and in the South. The number of these cooperative factories fluctuates considerably, as new ones are started every year while others close down. They are most numerous in the province of Udine, where they number several hundreds, while the total number in the country must amount to almost a thousand. The most modern example and the one which deals with the largest quantity of milk is that at Soresina (Cremona prov.).

Cow's milk cheeses. — These are of three kinds:

1. Moulded cheeses—such as Stracchino, Gorgonzola, Robiole, Fresa.
2. Hard cheeses — Grana (including Parmesan, etc.) Fontina, Bitto, Asino, Montasio, Bra; the skim milk (so-called Swedish) cheeses; “Margarinati” cheeses (in which butter fat is wholly or partially substituted by margarine); and the Swiss cheeses, Emmenthal, Gruyere.
3. Soft cheeses - whose name alters with their shape: Caciocavallo, Provolone, Scamorza, etc. Ricotta, a white curd sold in Italian cities, is usually a bye-product obtained from whey, but may also be prepared from fresh milk.

Stracchino and Gorgonzola are chiefly produced in Lombardy and to a slight extent in the adjoining plains of Piedmont; Fresa is a Sardinian speciality; grana comes from Milan, Southern Lombardy and Northern Emilia; Fontina and Bitto from the Alps to the west and north; Asino from Vicenza; Montasio from Udine, and Bra from Piedmont. Swiss cheeses are made in Lower Lombardy and the soft cheeses which used to be a speciality of the Abruzzi, Latium and the South are now also being manufactured in the North.

Butter is chiefly produced in Lombardy, either in the cheese factories or in special creameries; appreciable quantities also come from Veneto, Piedmont and Emilia. In certain southern provinces butter-fat is enclosed in a kind of bag made of soft, elastic curd, the whole being called “manteca”.

With regard to bye-products, lactose is only prepared by a very few factories; the extraction of casein is rather more general, and is supplanting the manufacture of skim-milk cheeses, which is no longer remunerative on account of over production. Other bye-products are “vituline”, a kind of calf meal, and dairy waste, which is used for pig feeding.

Ewe's Milk Cheeses. — This group of products has developed considerably of late years owing to their growing importance in the country's exports, and flocks are in consequence receiving more attention. The type of cheese varies from place to place, as a considerable proportion is still made for local consumption; the following may be mentioned as typical examples: Pecorino Romano, Cotrone, Moliterno, Pecorino Sardo, Cacio fiore, Incanestrato di Sicilia. Of these, the Pecorino has acquired commercial importance during the last twenty years. It originated in Latium, which is still the centre of production, but its manufacture has been considerably

extended in Sardinia, where up-to-date cheese factories have now been erected for the purpose.

Goat's Milk Cheeses. — These are small and only made for local consumption. Goat's milk is frequently mixed with cow's milk or ewe's milk to form so-called "mixed cheeses".

Buffalo's Milk Cheeses. — Small, round, soft cheeses are made with buffalo's milk, which is rich in fat. These are somewhat sweet with a pronounced flavour and find a market in the southern towns where they are sold under the names of: mozzarella, uova di bufala, provole, provature.

VALUE AND AMOUNT OF CHEESE PRODUCED.

In estimating the amount of cheese produced, it is assumed that :

cow's	milk	yields	7 per cent. of cheese
ewe's	"	"	15 "
goat's	"	"	10 "
buffalo's	"	"	20 "

After deducting from the cow's milk the amount used for butter-making, the annual production of which is estimated at about 50 000 tons, the amount available for cheese making is reduced to 23 000 000 hectolitres (505 million gallons). The production of cheese is, therefore, as follows :

cow's milk	16 100 tons
ewe's "	8 100 "
goat's "	1 500 "
buffalo's "	90 "
total	25 790 tons

To obtain the value of the total produce, butter and cheese are taken at the wholesale prices of 260 lire per quintal (11.8d per lb.) and 160 lire (7.3d per lb.) respectively as follows :

	annual value
butter	£ 5 200 000
cheese	" 16 505 000
bye-products	" 640 000
total	£ 22 345 000

FOREIGN TRADE.

Exports. — According to statistics published by the Ministry of Finance, exports of dairy products in 1913 were as follows :

	Amount tons	Value £
Fresh or sterilized milk	226	18 108
Fresh, sterilized and peptonised cream . .	0.75	528
Condensed milk, unsweetened	8	3 620
» » sweetened	251	120 588
Fresh butter	242	286 656
Salted butter	30	35 032
Cheese, Grana	916	916 480
» Swiss	94	79 084
» Pecorino	917	880 896
» Caciocavallo	211	227 748
» other hard types	155	148 808
» Gorgonzola, Stracchino	916	696 324
» other moulded types	7	4 916
Total		3 418 788

It will be seen from the above table that the largest exports consist of Grana, Pecorino and Gorgonzola cheese. The principal importing country is the United States, followed by Argentina, the cheese being consumed there by the large Italian immigrant population. Gorgonzola, however, goes chiefly to England, France and Switzerland.

Exports of cheese, have increased steadily since 1871, as shown by the following figures :

Year	Exports tons
1871	176
1879	266
1883	383
1887	503
1894	722
1899	1 043
1902	1 308
1906	1 919
1907	2 114
1911	2 785
1912	3 062
1913	3 277

Exports previously consisted almost exclusively of Grana, but both the amount and the number of kinds exported have now largely increased.

Imports. — A little butter and a considerable amount of cheese (about one-sixth of the export value) are imported annually, the imports for 1913 being :

Butter	40 tons
Swiss cheese	450 "
Other hard cheese	97 "
Soft cheese	12 "

Total annual cheese imports 559 "

valued at £549 868.

The cheeses mostly come from Switzerland; other hard cheeses are mostly Pecorino from the Levant. Imports were at their highest in 1887, when they reached 1235 tons; then they decreased rapidly and remained practically stationary at 450 tons until 1913.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

AGRICULTURAL
EDUCATION

592 - **Agricultural Education in South Africa.** — *Journal of the African Society*, Vol. XIII, No. 51, pp 288-295. London and New York, April 1914.

Agricultural education in South Africa is controlled by the Union Department of Agriculture, and under this head are embraced the activities of four Schools of Agriculture with Experiment Farms, eight Experiment Stations, and four Stud Farms, also a Household Science branch. For the better administration of these Institutions, a separate division of the Department was recently created, under the control of one of the Under Secretaries. There exist, in addition, Experiment Stations connected with the work of the Tobacco, Cotton, Horticultural and Botanical Divisions, but these are directly under the control of the Chiefs of these Divisions.

The annual vote for agricultural education, inclusive of salaries, general maintenance, and development, amounts to about £120 000, but this amount does not include grants through loan funds or votes on the Public Works Department's estimates for buildings. During the current year these amounted to no less than £60 000.

The principal schools are:

A. Cape Province:

1. EISENBURG, the oldest established of the Schools, with between thirty and forty students, is situated about thirty miles from Cape Town. Area of station 1 700 acres. Special features at this institution are horticulture, viticulture, wine-making, cereals and tobacco (Turkish).

2. GROOTFONTEIN, outside the town of Middelburg (Cape) with about eighty-five students. Area of station 25 000 acres. Special features at Grootfontein are agriculture (including irrigation under Karroo conditions), ostriches, Merino sheep and Angora goats.

B. Transvaal Province:

POTCHEFSTROOM, about eighty-three miles to the southwest of Johannesburg, with about sixty-five students. Area of station 4 000 acres. Spe-

cial features of the instruction are agriculture representative of High-Veldt conditions, cultivation of crops under irrigation and otherwise, cattle, maize and other cereals.

Natal Province :

CEDARA, fourteen miles to the north of Maritzburg. The station covers about 3 600 acres, and has some thirty students. Special features are sub-tropical agriculture, forestry (including wattle growing), cattle and maize.

Orange Free State Province :

There is no similar institution at present, but one is in course of establishment at Glen, near Bloemfontein. Arrangements have been made to receive students in 1915. A farm was purchased for the purpose at a cost of £20 000, and £40 000 has been provided on "loan funds" for the erection of the necessary buildings.

593 - **Technical Organization in German East Africa.** — *Deutsches Kolonialblatt*, Year XXV, No. 2, pp. 66-67. Berlin, January 15, 1914.

The following information has been received concerning the projected technical organization in German East Africa and the foundation of a native school for training practical mechanics at Daressalam :

The "Kolonial Wirtschaftliche Komitee" proposes opening three technical bureaus in the colony at Daressalam, Tanga and Lindi. These will be placed under the direction of competent certified engineers who have already had much experience in the colonies and will act as central consulting bureaus on all technical matters. The engineers will visit existing machinery on the plantations, advise, suggest improvements, etc. No fees will be charged for consultation other than the travelling expenses of the engineers.

At the same time a school for training practical native mechanics will be erected at Daressalam. The Committee have already rented a plot of land (23 680 square feet) from the Government up to October 1, 1919. The cost of building the school and its working expenses for the years 1914, 1915 and 1916 will be defrayed by funds voted by the metal and machine industry. The Government has already declared itself willing to instruct its officials in the different localities of the colony to select the most promising youths for instruction and to send them to the school. The number of pupils is at present limited to thirty.

The objects of the school are the following :

1. To train native mechanics and engine drivers. Only youths who have had some preliminary education and who are accustomed to working will be admitted. As encouragement they will get regular pay as soon as they enter the school.

2. To provide the railways, mines, internal navigation companies, factories and plantations in the colony with cheap technical labour, and, in time, to supply other German colonies also.

3. To act as an experiment station where German machines and implements will be tested and compared with foreign ones. People in the colony who are interested in machinery will be invited to attend the tests in order

to encourage useful discussions, and the Government will also be represented.

The education given in the school will be chiefly of a practical nature and will be adapted to the character of the natives. The first course will consist in rendering them familiar with all smiths', mechanics' and fitters' work, with the management of agricultural machinery and with the carrying out of all sorts of repairs. The second course will be more specially devoted to rendering the pupils capable of managing engines of all kinds, i. e. steam ploughs, machinery for hemp, cotton, rubber, etc., motor cars and boats and their repairs.

The machines and implements of the permanent exhibition will be included among the material available for the school. At the examinations held at the end of the course a Government commission will be present.

The chief stimulus to the foundation of the above school has been the scarcity of people capable of managing the cotton harvesting and other machines needed in the colony — a want which has hitherto been a serious handicap and prevented the extended use of machinery.

ORGANIZATION
OF EXPERI-
MENTAL AND
ANALYTICAL
WORK.

594 — The New Standards adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds. — EDLER, W. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 268-277. Stuttgart, April 15, 1914.

Owing to the difficulties which have arisen from alterations of the so-called Magdeburg standards, formerly universally recognized in the German beet-seed trade, the interested parties have drawn up a new set of rules. These differ from the earlier ones in that mangel and sugar-beet seeds are treated separately; further, instructions for the taking of samples and for the calculation of the deduction to be made on seeds not coming up to standard, but yet saleable, have been added.

German standards for the trade in sugar-beet seeds (1914).

The following bodies have taken part in the drawing up of the clauses given below: Ausschuss für Handelsgebräuche (representing the Deutscher Landwirtschaftsrat, Deutsche Landwirtschafts-Gesellschaft, Bund der Landwirte, Reichsverband der deutschen landwirtschaftlichen Genossenschaften für Deutschland and Vereinigung der deutschen christlichen Bauervereine), Verein der Deutschen Zuckerindustrie (Crude-sugar factory section) and the Gesellschaft zur Förderung deutscher Pflanzenzucht. These are valid where no other agreements are in force.

§ 1. — The sugar-beet seed should be delivered in good condition, fit for use, and, except for the screening necessary in cleaning, not graded according to the size of the clusters. The seed must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — The seed should contain at least 85 per cent. of dry matter (15 per cent. moisture). It is saleable with the dry matter down to 83 (17 per cent. moisture), but in that case the difference must be allowed for in the price (formula, § 5).

§ 3. — The purity should be at least 96 per cent (pure seeds after subtraction of impurities including clusters passing through a 2 mm., = 0.08 in., sieve). Seed is saleable down to 94.5 per cent., but the difference must be made up (formula, § 5).

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed	60 000
b) medium-cluster seed	65 000
c) small-cluster seed	70 000

Of this number, 70 per cent. must be up in 7 days.

One hundred clusters must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed	80
b) medium-cluster seed	75
c) small-cluster seed	70

Large-cluster seed is reckoned as containing not more than 40 clusters to the gram, medium-cluster 41 to 50, and small-cluster 51 or more.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

If the price is to be reduced under *either* § 2 or § 3, the reduced price is obtained by the following formula :

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}} ;$$

but if *both* § 2 and § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96.}$$

§ 6. — In the absence of any other agreement, samples must be taken within three days of the delivery of the goods, and by a sworn sampler. The directions for sampling are given in the appendix.

§ 7. — The determination of the conformity to agreement of the seed delivered is made by a station belonging to the Union of Agricultural Experiment Stations of the German Empire (Verband landw. Versuchsstationen im Deutschen Reiche) according to the method prescribed by this Union.

Each of the parties has the right to stipulate that the examination be made by a particular station belonging to the Union. The average of the two results is taken. Either party may also require a decisive analysis; no reasons need be given for this, but notice must be sent in within four days of the receipt of the first results; such analysis is to be made by a third station, selected by agreement or by drawing lots. In the demand for the decisive analysis it must be stated which determination is to be remade. In this case the average of the decisive analysis and the one which comes near-

est it on the disputed point is taken ; if the decisive analysis is half way between the other two, it is accepted.

Each party pays for his own original analysis, while the decisive analysis is paid for by the party requiring it.

§ 8. — If the presence of foreign beets, such as mangels, in the seed is complained of, a cultivation experiment is to be carried out in the same or the following year, using a certified seed sample. This is to be entrusted to an experiment station selected as for the decisive analysis. Each party may send an expert to judge of the result ; the director of the station fixes the day for this and acts as umpire.

Appendix. — Directions for sampling sugar-beet seeds.

1. *Taking the sample.* — Samples must only be taken from unopened consignments in sacks ; these must be so arranged that their number can be counted, or, if they are piled up, fairly accurately estimated. The lots must also be labelled in such a way that no doubt can arise as to their identity.

If the lot numbers more than 100 sacks, a sample must be taken from at least every twentieth sack ; if there are between 20 and 100 every tenth must be sampled, while for fewer than 20 sacks half must be sampled.

The sampler chooses the sacks from which he wishes to take samples ; these should be well distributed through the lot ; further the different samples should come from different parts of the sacks, and for this purpose he may have a certain number of the sacks emptied. At the request of one of the parties concerned, all the sacks to be sampled may be turned out. If, for want of room or other reasons, it is not practicable to empty the sacks, this fact must be noted in the report. The use of a sample bore is only allowed provided there is no possibility of its damaging the seed.

The sampler must be provided with the necessary labour for the work of sampling.

Sampling in a railway truck is allowable ; the same directions apply in this case.

2. *Treatment of the sample.* — The average sample made up from the small portions is thoroughly mixed and then divided into separate samples according to the number of analyses required.

The samples for the determination of moisture and purity are to be enclosed in clean and dry air-tight vessels of glass or tin ; the openings are then to be sealed with sealing-wax, rubber, wax or some similar substance ; ground-glass stoppers should be greased. The samples must be tightly pressed into the glasses or tins. Each sample must weigh at least 200 gms. (7 oz.).

The samples for the determination of germination capacity are to be preserved in cloth bags or double paper bags ; they may not be enclosed in air-tight vessels. Each of these samples must weigh at least 200 gms. (7 oz.).

The samples must be sealed or leaded by the party or parties present in such a way that it is impossible to open them without damaging the cover-

ing. When the samples are sealed, the sampler must label them ; for tins a properly adhesive sealed paper label is used, for bags a tie-on label ; in either case he must write on it the reference number from his diary, place and date of sampling, brand and number of the sacks making up the lot, name of the purveyor or receiver (even supposing him to be only temporarily in possession of the seed), and the apparent nature of the packing ; this information he certifies by his signature. If the sample is taken in a railway truck, the number of the truck must also be entered on the label.

If required, the sampler must provide a duplicate copy of this label, describing the nature and appearance of the seal or lead.

The sampler must see to the provision of the implements and materials necessary for the sampling.

3. *Number and destination of the prepared samples.* — The sampler has to prepare, according to instructions, 4 or 5 samples in glass vessels or tins and the same number in cloth or paper bags. He must send off those required within twenty-four hours to the addresses furnished by the person under whose instructions he is proceeding. He must also send one duplicate sample each to the purchaser and the vendor, while one he keeps himself.

The samples should be kept in dry unheated rooms. The sampler must keep his sample for a whole year, and must not part with it or deposit it for judgment except on the combined demand of vendor, purchaser, committer and receiver.

A duplicate copy of the label should be given to the temporary possessor, provided he is not the committer.

If the interested parties require it, the sampler may make more than the 4 or 5 samples, in return for a proportionate fee, but these must only bear his seal.

4. *Obstacles to sampling.* — If the sampler finds himself unable to observe these instructions, he must abandon the sampling.

German standards for the trade in mangel seeds (1914).

The following bodies have taken part in the drawing up of the clauses given below : Ausschuss für Handelsgebrauche (representing the societies named above), Gesellschaft zur Förderung deutschen Pflanzenzucht, and Vereinigung der Samenhändler Deutschlands. These are valid where no other agreements are in force.

§ 1. — The mangel seed must be delivered in good condition and fit for use ; it must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — As for sugar-beet seed.

§ 3. — As for sugar-beet seed, except that purity as low as 94 per cent. is allowed.

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum of 60 000 seedlings. Of this number, 42 000 must be up in 7 days. The seed is saleable with only 50 000 seedlings per kilo, but the deficit below 60 000 must be allowed for in the price.

One hundred clusters should give in 14 days a minimum of 75 seedlings for large-cluster seed and 70 for small-cluster seed. The seed is saleable with these figures down to 70 and 65, but the deficit must be made good. Large-cluster seed is reckoned as containing not more than 45 clusters to the gram of pure seed, small-cluster 46 or more.

In calculating reduction of price, an excess or deficit of seedlings per kilo may be set against a deficit or excess of germinating clusters, but the minimum value must come up to the standard. At the same time no raising of price is allowable. For the calculation of the reduction of price the formulae given in the Appendix are to be used.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

§ 6. — As for sugar-beet seed.

§ 7. — Differs from that for sugar-beet seed in that the station to make the decisive analysis is not to be selected by drawing lots; if the parties cannot agree within eight days, the president of the Deutscher Landwirtschaftsrat nominates a station belonging to the Union. Further, in case of delivery contrary to agreement the vendor bears all the costs of analysis.

§ 8. — If the purchaser considers the colour (within the variety) of importance, he may propose a determination of this by germination tests; any complaint on this point must be made within eight days of the receipt of the examination certificate. If complaint is made as to the correctness or purity of the variety, a cultivation experiment made in the same or the following year, using a certified seed sample, is to decide the question. This is to be carried out by a station selected in the same way as for the decisive analysis. The result is judged as under § 8 for sugar beets.

Appendix. — Directions for sampling mangel seeds.

Unless carried out by a sworn sampler, the sampling takes place as follows:

For lots up to 10 packages, all the packages must be drawn upon in the preparation of the sample; with more than 10, one in ten must be used, with the proviso that at least 10 remain unopened.

Injured packages are not to be used even when accepted by the purchaser.

The packages selected are to be opened in such a way that samples may be taken from the top, the middle and the bottom, or else so that they can be turned right out and the seed well mixed; at least ten samples are then to be taken from the heap (top, middle and bottom). The samples so obtained are to be put together, carefully mixed and divided into at least four equal parts. Each of these parts must weigh at least 200 gms. (7 oz.).

The samples for the determination of moisture content are to be enclosed in air-tight glass bottles or tins (as for sugar-beet seed). Those for germination tests are to be packed in linen or double paper bags, and must not be kept in air-tight vessels. All must be labelled in such a way that their origin can at any time be ascertained.

An impartial witness must be called in for the sampling; he stamps the seals or leads of the closed samples with his seal. The sample remitted must be accompanied by the witness' certificate of sampling, on which it must be stated that the samples were duly taken in his presence. The other samples must be kept in a dry unheated room in case they should be required for further investigations.

The vendor has the right to have similar samples taken on the purchaser's property, at his own expense, for examinations which he wishes made. If both parties have had samples taken, each must send in his sample for comparison in case a decisive analysis is required; the average of these two samples is taken as the decisive figure.

*Formulae for the calculation of reduction of price
on seeds below standard but saleable.*

In the formulae, the values for dry matter and purity may only be inserted if they are within the limits set out in the regulations.

A balancing of excesses and deficiencies is only allowable in germination values (see § 4 above). No latitude is allowed outside the limits for delivery given in the regulations.

If the price is to be reduced under either § 2 or § 3 the following formula is to be used:

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}};$$

but if both § 2 and § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96}.$$

If reduction is to be made under § 4 it is obtained as follows:

$$\text{price agreed upon} \times \frac{\begin{array}{c} \text{seedlings germinating} \\ \text{in 14 days in 1 gm.} \\ 60 \end{array} + \frac{\begin{array}{c} \text{clusters germinating} \\ \text{in 14 days} \\ 75 \text{ (or 70)} \end{array}}{2}$$

In the last formula, the two figures for germination must both be entered, even when one of them is up to or above standard.

If reduction is required under §§ 2, 3 and 4, the corrected price from the second formula is substituted for "price agreed upon" in the last formula.

595 - Agricultural Shows.

Argentine Republic.

1914 Aug. 15-23. Buenos-Aires. — Agricultural show organized by the "Sociedad Rural Argentina".

Belgium.

1914 Aug. 29 (opening). Arlon. — Regional agricultural competition, organized by the "Société agricole de Luxembourg"; there will also be an agricultural exhibition, including several international sections. Address to "Secrétariat de la Société agricole du Luxembourg", Arlon, Belgium.

AGRICULTURAL
SHOWS AND
CONGRESSES

Canada.

- 1914 Sept. 3-12. Vancouver. — Agricultural and industrial exhibition.

Egypt.

- 1915 Feb. or early March. Cairo. — Agricultural show organized by the Khedivial Agricultural Society.

France.

- 1914 Sept. 11-13. Quimper. — Show of Breton Black-and-white Cattle. Also exhibition of agricultural machines and implements, and trials of potato-diggers.
Dec. 24-28. Paris, Grand Palais. — International Poultry and Rabbit Show, held by the "Société nationale d'Aviculture de France". Address of the Society: 34, rue de Lille, Paris.
1915 March 4-8. Nice. — Great Triennial Flower Show, organized by the "Société d'Horticulture pratique de Nice."

Germany.

- 1914 Sept. 19-23. Siegburg. — Provincial show, held by the "Landwirtschaftlicher Verein für Rheinpreussen."
Oct. 3-5. Hamburg. — Fourth fat stock show.
1915 May 8-11. Karlsruhe. — First fat stock show for Baden, organized by the city of Karlsruhe and the Chamber of Agriculture of the Grand Duchy of Baden.

Italy.

- 1914 Sept. 20-30. Quistello (Mantua). — Dairy industry show. Also national poultry show, interprovincial pig show and exhibition of agricultural produce.

United Kingdom.

- 1915 Edinburgh. — Competition for potato-planters. Address to: J. Stirling, 3 George IV Bridge, Edinburgh.

United States.

- 1915 Jan. 1-Dec. 31. San Diego (California). — International Exhibition, with the following sections: Agriculture; Food Products; Commerce and Industry; Domestic Economy.

596 — Agricultural Congresses.*Austria.*

- 1914 Sept. 5-13. Göritz. — Ninth Austrian Wine-makers' Congress. Address: Geschäftsleitung des österreichischen Reichs Weinbauvereines, Wien III, Fasangasse 48.

France.

- 1914 Aug. 3 (opening). Lyons. — National congress on technical education in industry, commerce and agriculture. General Sec., 5 rue Jussieu, Lyon.
1915 April 6-9. Marseilles. — 53rd Congress of the Sociétés Savantes.

Hungary.

- 1914 Sept. 6-17. Budapest. — Eighth Congress of the International Union of Forestry Research Stations. Excursions will include: Szabadka (trials of fixation of shifting sands, stands of *Robinia*); Kiralyhalom (Secondary Forestry School); Puszta of Déliablát (old stands of Scots and Austrian pine, and plantations of *Robinia* carried out in a special way on shifting sands); Vadászerdő (forests of pedunculate oak, plantation of foreign trees and experimental plots); Gödöllő (Arboretum of the Archduke Joseph); Selmeczbánya (Central Hungarian Forestry Research Station, comprising: arboretum, nursery, experimental plots, meteorological station); Ohogy (domainial forest); Lake of Csorba, at 4500 ft. — Persons wishing to attend the excursions and meetings should send their names to the Secretariat of the Union, 3 rue de Louvain, Brussels.

CROPS AND CULTIVATION.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

597 - Variation in the Nitrate Content of the Soils in Scania, Sweden. — WEIBULL, M.
in *K. Landbruksakademiens Handlingaroch Tidskrift*, Year 53, No. 2, pp. 65-93.
Stockholm, 1914.

The writer employed the Grandval-Lajoux method of estimating nitrates in soils, which proved very delicate and reliable. Samples were taken from different points of a soil and tested separately, not mixed to form a composite sample, as the variation from point to point may be considerable; care was also taken not to sample a soil twice in the same place, as each disturbance causes increased aeration and influences nitrification.

During five years the soil of a field was systematically tested for nitrates both on cropped and uncropped plots, to follow the variations due to season and soil management; manurial dressings were identical on the cropped and uncropped plots. The results are set out in Table I (p. 860); the treatment of the field was as follows:

- 1907. — Seeds: mown in June, dunged, ploughed and harrowed and sown with wheat on September 2.
- 1908. — Winter wheat: received 180 lbs of nitrate of soda per acre on April 24, harvested on August 12, dunged and ploughed September 12.
- 1909. — Sugar beet: received a dressing of nitrate of soda May 20, lifted October 21, ploughed November 15.
- 1910. — Spring wheat: sown April 8, harvested in August, dressed with liquid manure and ploughed November 11.
- 1911. — Peas: sown in May, harvested August 10.

The nitrate content never exceeded 22 parts per million on cropped soil, while on fallow land it rose to 33. Among the cropped plots, those under beets contained up to 14 parts of nitrogen, those under wheat and peas only 8 or 9 parts, and those under seeds least of all (*viz.* 1.5 parts), but as soon as the latter were dunged and ploughed up nitrates increased to 6 parts per million and continued to accumulate right up to November, developing a nitrate content of 21 parts per million. Then the content decreased owing partly to absorption by the growing wheat and partly to washing out by rain, a loss which was verified later on other fallow plots. In the spring, nitrates were scarce; nitrification began again at seeding time but the nitrate content only became appreciably higher after the application of nitrate of soda, *i. e.* towards the middle of May. During the early summer the nitrate content generally increased, as did nitrate assimilation, evidenced by the difference between cropped and uncropped plots.

Influence of cultivations and vegetation on the nitrate content of soils. — In 1910 a piece of new ley (clover and grass in equal quantities) was divided into three equal parts of 10 sq. metres (107 sq. ft.) each; one of these was left in seeds, the second was freed from grass and clover and

TABLE I. — Nitrogen as nitrate in the soil to a depth of 12 in., parts per million.

Month	1907	1908	1909		1910		1911	
	Seeds, winter wheat sown (1)	Winter wheat (1)	Beets (1)		Spring wheat (1)		Peas (1)	
		Cropped land	Cropped land	Fallow land	Cropped land	Fallow land	Cropped land	Fallow land
Jan.	—	2.5 1	3	—	—	—	3	—
Feb.	—	1.5 2.5	—	—	—	—	—	—
March	—	1.5 2.5	—	—	—	—	3 2.5 2 3 2.5 2	—
April	—	3 1.5 7	— 2.5 2	— 2.5 5	2 5.5 3.5	2.5 5.5 3.5 4.5 6	4.5 5 5 3.5	—
May	—	5 2.5 1	3 2.5 10.5 3	7 3	8 9 8.5	4.5 7 4.5 5.5 8	7 3.5 7 5	—
June	—	3 2.5 1.5	7 14 13	7.5 12 12	3.5 4 2.5	6.5 4.5 4.5 6.5 4.5	2 4 7 4	—
July	—	—	14 6	3.5 21 32 33	2.5 1.5 1.5	4 3.5 4 2 2 5	3.5 3.5 3.5	—
Aug.	1.5 6 7.5 8.5 9.5	1 2.5 1	1.5 1	1.5 16 14.5 11.5	1.5 4.5 2.5 5	8 5 2.5	— 4.5	—
Sept.	7.5 14.5 10 14	1 1.5 2	1.5 2	1.5 10.5 12	4.5 1.5 3	8 4 5.5	—	—
Oct.	20 14 20 21	3	1 1.5 2	16 16 7.5	1 2 1	2 2 2	—	—
Nov.	21.5 21 17 13.5 8	6	—	—	2 2	2 2	—	—
Dec.	9.5 6.5 4.5	—	1.5 4 2	7.5 8 5.2	1	2	—	—

(1) Samples taken every week.

kept bare of vegetation and the third was dug over to a depth of 12 in. on March 8. Nitrate and moisture contents are given in Table II.

TABLE II.

Date	Nitrates as N in parts per million			Moisture per cent		
	In seeds	Bare, weeded	Dug	In seeds	Bare, weeded	Dug
April 8	1.5	2.0	1.5	—	—	—
» 21	2.1	4.7	2.3	—	—	—
May 2	2.8	5.3	4.0	—	—	—
» 11	1.5	3.7	6.5	—	—	—
» 21	1.8	4.7	5.7	—	—	—
June 1	1.7	5.7	14.0	—	—	—
» 10	3.3	7.0	18.7	5.3	8.6	9.7
» 19	3.7	6.8	14.0	—	—	—
July 1	4.3	—	12.0	—	—	—
» 10	2.0	10.3	19.7	—	—	—
» 20	3.0	9.7	24.0	—	—	—
Aug. 1	2.3	9.7	11.3	6.7	10.1	10.25
» 11	1.5	7.7	10.3	8.81	10.82	10.25
Mean . .	2.4	6.5	11.3			

Nitrate content of the control plot in seeds remained low, averaging 2.4 parts per million and reaching a maximum of 4.3 parts at the beginning of July when vegetation was already in an advanced condition; this plot was always driest. In the bare weeded soil the nitrate content was about three times as large and did not attain its maximum till later in July. In the dug over plot the nitrate content was about twice that of the second plot, but the moisture content remained approximately equal.

Influence of nitrate content on yield. — Samples of soil were taken throughout the growing season on a certain number of farms from plots having received a dressing of nitrate of soda, superphosphate and potash and from unmanured plots; these samples were analysed for nitrates. The results show that soils in Sweden do not generally contain sufficient nitrate to provide for the requirements of plants, and this is especially the case with land under cereals or grass; corn fields will only attain a nitrate content of 10 parts per million if they have been dressed with nitrogenous fertilizers and will reach their maximum at the end of May or beginning of June; grass fields are usually lowest of all. Land under root crops or fallow is usually richer, and root fields may contain as much as 10 parts per million towards the end of June. When land is broken up after harvest, nitrification be-

comes active and nitrates accumulate more than at any other time. The maxima reached earlier in the season are only maintained a very short time, for nitrification decreases and plant assimilation is active; on unmanured fields, nitrates become scarce after one or two months and crops suffer from starvation; on manured soils a somewhat higher nitrate content is maintained for some time.

The writer investigated the question as to whether it were possible to detect the point at which nitrogenous manuring becomes necessary. Soils under beets were analysed during July and August; the results are set out in Table III.

TABLE III — *Soils under beets.*

Place of trial	Yield on unmanured soil	Increase due to complete manuring	Nitrates as N in parts per million					
			July I	July II	July 2I	Aug. I	Aug. II	Aug. 2I
	tons	tens						
Alnarp 1909	39.0	0.6	9.3	6.3	6.2	2.5	1.7	1.7
Barsebäck	35.6	3.5	13.0	6.7	—	4.0	3.7	—
Alnarp 1910	41.3	4.0	10.7	6.3	2.8	3.7	5.0	2.2
Ola Siversson . . .	30.9	4.4	14.7	7.3	8.0	3.0	2.3	—
Alnarp 1908	40.5	4.7	7.3	6.3	2.7	1.7	1.8	2.5
Månsson Örnerup .	33.1	6.6	7.7	4.3	—	2.3	2.3	—
Alnarp 1907	30.0	6.6	8.5	8.0	2.0	2.5	4.0	1.2
Bomhög	37.0	7.8	8.0	5.8	2.0	1.7	1.0	1.7
Mean			9.9	6.4	4.0	2.5	2.6	1.9

In the course of the two months, the mean nitrate content fell gradually from 9.9 to a minimum of about 2 parts per million. If the time at which this minimum content is first observed in each case be considered in relation to the increase in the crop caused by the nitrogenous manuring, it would appear that when the depletion of nitrate (2 parts per million) occurs early in the season, *i. e.* before the beginning of August, a nitrogenous dressing causes a fairly large increase of crop, but that the increase is less considerable if the scarcity of nitrates does not make itself felt till the middle or end of August; these dates would be liable to modification with the character of the season. The nitrate content of plots dressed with nitrate of soda never sank to such a low level as that of the unmanured plots.

Under normal climatic conditions then, a nitrate content of 2 parts per million at the end of July in unmanured fields of beets would indicate the necessity of applying a nitrogenous dressing, while if this low level does not appear till the middle or end of August, the natural content of the soil would be sufficient for the crop. According to RÉMY, it is just in July that beets develop a high capacity for assimilation, so that the results obtained above would not be unexpected. Probably a similar

period of maximum assimilation exists for other cultivated plants and it would be of great interest to extend investigations to other crops. Three trials carried out with forage crops gave in one case a large increase with a nitrogenous dressing, in the second case an appreciable increase, and in the third no increase, while the nitrate content of the respective soils sank to the critical point (2 parts per million) in June and before August in the two first cases, while the scarcity was never apparent in the third case. In one trial with potatoes the nitrate content of the soil sank to 2 parts per million on July 1, and a handsome increase was obtained with a nitrogenous dressing. In three trials carried out with spring corn, scarcity of nitrates was observed in one case in May and in the two other cases on August 1 and August 11; response to nitrogenous dressing was only obtained in the first case.

598 - **Experiments on the Rate of Nitrification.** — BEESLEY, R. M. in *Journal of The Chemical Society*, Vols. CV and CVI, No. DCXVIII, pp. 1014-1024. London, April 1914.

The rate of nitrification was determined for the following substances: carbamide, thiocarbamide, uric acid, asparagine, glycine, acetamide, aniline sulphate, methylamine sulphate, ammonium oxalate and ammonium sulphate and a special form of apparatus was devised so as to enable samples of the nitrifying solutions to be withdrawn without exposing the contents to accidental contamination from the organisms contained in the atmosphere. A suitable mixed culture of hydrolytic and nitrifying organisms was obtained from the secondary contact beds of a local sewage works. The course of hydrolysis and nitrification in the various solutions was traced by means of periodic determination of the ammoniacal, "nitrous" and "nitric" nitrogen figures. The ammoniacal nitrogen was determined by direct Nesslerisation of diluted portions of the nitrifying solutions. During the early stages of fermentation the "nitrous" nitrogen was determined by means of the anaphthylamine and the sulphanilic acid test, but as the concentration reached 3 parts per hundred thousand, Duyk's volumetric method using iodine was adopted. The first appearance of nitric acid was detected by means of brucine and sulphuric acid, and the quantity of "nitric" nitrogen was determined as ammonia by reduction with a zinc-copper couple.

No nitrification took place in the solutions containing thiocarbamide and aniline sulphate. Ammonia was produced in the latter to the extent of 90 per cent. of the original nitrogen in solution, showing that the aniline was merely hydrolysed. However, no phenol was detected, probably owing to its destruction by bacterial agency. Nitrification took place in all the other solutions at approximately the same rate. In the case of the ammonium salts there was a temporary disappearance of nitrogen between the 30th and 60th days of fermentation. This loss of nitrogen becomes noticeable before any nitrate makes its appearance, and since the oxidation from nitrous to nitric acid consists of only one step it appears that it is in some stage of oxidation between ammonia and nitrous acid that the nitrogen becomes non-realizable.

The writer therefore concludes that intermediate substances of the nature of hydroxylated ammonium radicles are formed in the bacterial oxidation of the ammonium radicle.

599 - **Humus in California Soils.** — LOUGHRIDGE, R. H. in *California College of Agriculture Experiment Station, Bulletin No. 342*, pp. 49-92. Berkeley, Cal., January 1914.

The soils of California are characterised by the presence of humus to beyond twelve feet below the surface. There is not the sharply defined change of the black humus colour to grey at a depth of 6 or 9 inches, characteristic of normal humid soils. In some of the heavy clay soils a change in colour takes place at a depth of three feet, but for the most part the change in tint is very gradual downward through many feet. The average quantity of humus in 109 Californian soils is 1.35 per cent. for the first foot and a sum of 3.17 per cent. for the first three feet, equivalent to about 126 800 lbs. per acre. The average humus content of 280 humid soils of the United States is 2.63, or approximately 105 600 lbs. per acre.

Thus, even excluding the humus below a depth of 3 feet, the arid soils of California contain more humus than the humid soils of America. The wonderful endurance of drought on the part of plants in Californian soils is due to this distribution of humus through a depth of many feet and the consequent deeper root penetration.

Professor Lipman has shown that nitrifying bacteria are present and active in California soils to a depth of six feet, and ammonifying bacteria are present through a depth of twelve feet, thus making available the nitrogen content of the humus to these depths.

Phosphoric acid is present in the humus of Californian soils to the extent of from 0.01 per cent. to 0.08 per cent. throughout the entire depth, though usually most abundant in the upper few feet.

600 - **Soils with a Mineral Acidity.** — LOEW, O. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 161-164. Berlin, 1914.

According to the writer, in considering soils with an acid reaction, a distinction is to be drawn between those in which this property is due to the presence of humus, and those which have a mineral acid reaction.

Soils with mineral acidity have recently formed a subject of research for agricultural chemists. Daikuhara, who was the first to turn his attention to this question, reported seven years ago that soils devoid of humus might have an acid reaction, and that this acid property was due to the clay. He also found that such soils exist, not only in Japan, but also in Corea and along the Chinese coast, countries in which the frequent summer rains may wash the basic elements out of the soil. Acid clays are also found fairly frequently in Germany and in the United States. According to Daikuhara these soils, when manured with neutral salts, as, for example, chloride of potash or sulphate of ammonia, become even less fertile than they would be without any manure, because the insoluble acids of the clay, uniting with the bases, liberate acids (in this case sulphuric and hydrochloric), and thus increase the acid nature of the soil. The writer concludes that acid soils should only be manured with basic fertilizers.

601 — **The Influence of Irrigation and Crop Production on Soil Nitrification.** — MCBETH, I. G. and SMITH, N. R. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 40, No. 1-8, pp. 24-51. (article written in English). Jena, February 16, 1914.

PERMANENT
IMPROVEMENTS
DRAINAGE AND
IRRIGATION

These nitrification studies were carried out on the Greenville Farm belonging to the Utah Agricultural Experiment Station. The soils are of sedimentary origin and contain no particles larger than "fine sand". Chemical analysis shows them to be exceptionally rich in the mineral plant food constituents, but characteristically low in humus and possessing only a fair nitrogen content. The surface soil to a depth of one foot contains 43 per cent. of calcium and magnesium carbonate in the ratio of 1 lime : 2.8 magnesia.

The influence of irrigation and growing crops on nitrification was determined by measuring the rate of nitrification of ammonium sulphate and dried blood when added to samples of the soils. Water from the Logan River was used for irrigation and was of fairly constant composition during the season. Analysis showed it to have a very low fertilising value and to contain less than 400 parts of total residue per million.

The results obtained in these experiments are as follows :

1) The nitrifying power of the surface foot of soil was ten times that of the second foot and many more times that of the third, fourth, and fifth foot respectively.

2) Irrigation decreases the nitrifying power of soils, especially in the first two feet. This effect continues during the following season.

3) More than 50 per cent. of the full water capacity of the soil is required for maximum nitrification, but the quantity varies considerably with different soils. Maximum nitrification is generally secured when the soil is just on the point of becoming sticky. Too small a supply of moisture has a greater effect in retarding nitrate formation in these soils than a too liberal application.

4) The addition of a quantity of nitrogen as ammonium sulphate greater than 170 parts per million showed an inhibiting action on the nitrifying organisms. In no case was as much 50 per cent. of the nitrogen added as ammonium sulphate recovered in the form of nitrate.

5) Growing crops such as alfalfa, potatoes, oats and corn increase the nitrifying power of the soil, the effect being greatest in the case of alfalfa.

6) The greatest gain in nitric nitrogen was obtained from the alfalfa land when ammonium sulphate was used as the nitrifiable substance; when dried blood was substituted for ammonium sulphate, the greatest gain was from the oats land.

7) The smallest gain with both ammonium sulphate and dried blood was obtained from the fallow land.

609 — **The Great Artesian Basin of Australia.** — *Journal of the Royal Society of Arts*, Vol. LXII, No. 3202, pp. 438-440. London, April 3, 1914.

The largest of all artesian basins is that in the eastern half of Australia, and it has been brought into prominence recently by the discovery of

a serious falling off in the supply. A Conference of the most eminent geologists and engineers from all the States was appointed with the object of discovering the cause, in view of arresting the decline in the output, and now its report has been published. The basin in question is roughly triangular in shape, and about 1000 miles in maximum length from north to south and about the same from east to west. The intake surface beds which supply nearly all the water are on the eastern side of the basin, being in a more rainy country than on the west, and they coincide generally with the western slope of a belt of high country parallel to and about 200 miles from the coast. This belt is for the most part composed of porous Triassic freshwater sandstones. It has been estimated that 13 200 million gallons daily reach the stratum down to which bores are being driven, while about 700 million gallons are being drawn from the wells. As in most artesian basins, the lip of the subterranean basin dips in some places and allows a certain amount of water to escape; in this particular case also, it has been ascertained that there is a considerable escape at the north end into the Gulf of Carpentaria.

The first discovery of artesian water was made in 1879; since then 84 000 square miles of country in New South Wales and 376 000 square miles in Queensland were found to be water bearing under natural pressure. Large areas of these tracts are within the 10-inch and the 20-inch average yearly rainfall, these amounts being also exceedingly irregular in incidence. Therefore as bore sinking advances vast pastoral districts in which millions of sheep died in drought times, are gradually being transformed into areas in which access to water is ensured, and great losses of stock are avoided.

According to latest returns 2 336 wells have been sunk, yielding, as said above, 700 million gallons daily. The maximum and minimum depths are 5 045 feet and 5 feet, and the temperature of the water ranges from 148° F. to 70° F., increasing approximately 1° for every 44 feet.

The wells are almost exclusively used for watering stock, but in some places they have been used for township water supply and for the production of power, but not for irrigation, the quantities being generally too small. The recent Conference has advised prohibiting (with some exceptions) the employment of the water for any purpose other than that of watering stock.

The diminution in the supply had been noticed in a few cases since 1894, but about 10 years ago it became clear in many instances and since then it has become more or less marked over all the area of the great basin.

It was thought by some that local escape through defective casing of the bores or occasional drought over the intake beds might be the cause of the mischief, but the evidence before the Conference was not considered sufficient to confirm these opinions.

The Conference, in spite of the voluminous evidence collected, has not been able to come to any definite and complete conclusion as to the cause of the decline in the supply, and it has confined itself to recommending that more data be furnished to a Permanent Board sitting annually and that the laws affecting artesian water supply be made uniform in all the States.

603 - **Progress in Irrigation in South Africa.** — *Daily Consular and Trade Report*, Year 17, No. 40, p. 786. Washington, February 27, 1914.

Under the system of irrigation boards, no fewer than 30 districts have been proclaimed in the Cape Province alone, the capital expenditure involved being \$4 136 000; a number of Government irrigation settlements exist in the Cape, Transvaal and Orange Free State Provinces. Boring is proceeding on nearly 500 farms and during the year ended March 31, 1913, 93 holes were completed having a total footage of 18 440 and a yield of 1 321 500 gallons per day.

The pumps most in use in South Africa are a reciprocating type suitable to varying capacities and heights and to installations where the water supply is irregular.

In regard to motive power for small pumping installations, oil engines up to 6 HP are very commonly used. For larger installations suction gas plants are extensively employed, the most important to date being a 108 brake HP equipment at Grahamstown. In some districts anthracite coal is available and cheap to use, but suction gas plants are more widely in demand and are already the accepted type for irrigation works of any size.

604 - **Technical Precautions Necessary in the Electrification of Crops.** — PRIESTLEY, J. H. (Some recent experiments in the application of electricity to plant production) in *The Gardeners' Chronicle*, Vol. LV, No. 1424, pp. 245-247 and No. 1425, p. 271. London, April 18, 1914.

TILLAGE AND
METHODS OF
CULTIVATION

Previous experiments have been carried out in ignorance of the complication and sources of error attendant in the management of high potential discharges. The technical difficulties to be overcome are:

1. Adequate insulation of the wires.
2. Changes in the area of distribution of the discharge by wind.
3. A simple and accurate method of determining the electrical condition of the atmosphere above each plot.

The changes in the direction of the discharge produced by changes in the intensity and direction of the wind will confuse the issue of all experiments, however carefully planned otherwise, if precautions are not taken to ensure normal electrical conditions for the control plots. The difficulties of controlling the electrical conditions without interfering with the other physical conditions of the plots are so great that it is necessary to make accurate records of the electrical condition of each plot throughout the experiments before the results can be interpreted satisfactorily. Further, no comparisons of experiments made in different localities, or at different times, can be made, unless the particular electrical conditions prevailing at the time are considered.

Efficient insulators and a simple apparatus for the determination of the distribution of the electrical discharge have been devised. With a due appreciation of the importance of these factors, the application of electricity to growing crops becomes a simple matter, and distinct improvement in the progress of this study is to be expected.

MANURES AND
MANURING

605 — **Production and Consumption of Fertilizers in the World.** — INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *Production et consommation des engrais chimiques dans le monde*, Second edition, pp. 162. Rome, 1914 (1).

The production, consumption and trade in fertilizers is of an eminently international character, as no country is in a position to provide for all its own wants in that respect; moreover, while the use of artificial manures is gradually spreading to all cultivated parts of the globe, the raw material from which they are produced is concentrated in only a few points. The present edition of the above publication has been completed with regard to the world movement of fertilizers by data for the colonies which were not available in 1913.

Production.— The world's production of the principal fertilizers during 1910, 1911 and 1912 is given in Table I, together with similar data for 1903.

TABLE I. — *Total production of fertilizers (metric tons).*

	1903	1910	1911	1912
<i>Phosphatic manures.</i>				
Mineral phosphates	3 098 866	5 609 760	6 181 199	6 852 343
Basic slag	3 243 500	3 275 845	3 506 500	3 988 000
Superphosphate	5 130 900	9 604 260	10 000 000	11 000 000
Guano	71 100	61 000	83 000	72 000
Total . . .	10 544 366	18 550 865	19 770 699	21 912 343
<i>Potash manures.</i>				
Potash salts	4 078 268	9 285 408	10 985 760	12 531 216
(containing K_2O)	(366 421)	(857 883)	(939 927)	(1 009 219)
Indian saltpetre	18 711	16 140	14 910	15 036
Others (given as K_2O)	—	28 000—44 000		
<i>Nitrogenous manures.</i>				
Nitrate of soda	1 485 279	2 465 415	2 522 120	2 586 975
Sulphate of ammonia	582 206	1 053 994	1 198 363	1 327 508
Cyanamide	—	30 000	52 000	95 000
Nitrate of lime	25	25 000	50 000	75 000
Total . . .	2 607 510	3 574 409	3 822 483	4 084 483

The Seychelles have recently provided a new source of guano, producing 22 260 metric tons in 1911.

(1) Price 3.50 fr., to be obtained of the International Institute of Agriculture, Rome

The figures for the total amount of phosphatic manures are too high, as the mineral phosphates are counted twice over, being largely used in the manufacture of superphosphate.

It is not possible to give exact figures for the total production of potassic manures, but the great bulk of these is in the form of potash salts (Stassfurt). Modern developments in the production of potash manures consist in the extraction of potash; 1) from seaweed in the United States, by which means it is estimated that an annual yield of 1 000 000 tons of potassium chloride (equivalent to 630 000 tons of K_2O) might be obtained; and 2) from the feldspars, also in the United States, by which means a possible annual yield of 400 000 tons of potash is estimated.

With regard to the nitrogenous fertilizers, the production of sulphate of ammonia is five times as large as it was twenty years ago, and there has lately been introduced a new method of extracting it from peat; the process, known as the Mond-Frank-Caro process, extracts from 90 to 180 lbs. of sulphate of ammonia from one ton of peat. The production of synthetic nitrogenous fertilizers since 1903 is given below, together with estimated figures for 1913 and 1914 (in brackets).

	Calcium cyanamide metric tons	Nitrate of lime metric tons
1903	—	25
1904	—	550
1905	—	1 600
1906	500	1 600
1907	2 200	15 000
1908	8 300	15 000
1909	16 000	25 000
1910	30 000	25 000
1911	52 000	50 000
1912	95 000	75 000
1913	(97 000)	(140 000)
1914	(208 000)	—

Particulars as to the place of production of mineral phosphates, basic slag and sulphate of ammonia are as follows:

Mineral phosphates.

United States	3 216 046 metric tons
Tunis	1 923 000 "
Algeria	388 515 "
France	300 000 "
Christmas Island	300 000 "
Ocean and Mauri Islands	300 000 "
Belgium (excluding phosphatic chalk)	203 100 "
Egypt	69 958 "
Angaur (Palau Islands)	50 000 "
Makatea (Society Islands)	40 000 "
Dutch Antilles	20 362 "

Russia	25 000 metric tons
South Australia	6 198 "
French Guinea	7 230 "
Spain (1911)	3 520 "
Japan, apatite (1911)	2 271 "
Sweden (1907)	5 317 "
Norway (1911)	897 "
Canada	164 "
<i>Basic slag.</i>	
Germany	2 475 000 metric tons
France	679 000 "
Belgium	534 000 "
United Kingdom (1910)	160 000 "
Austria-Hungary	73 000 "
Others, including United Kingdom (1911)	200 000 "
<i>Sulphate of ammonia.</i>	
Germany	492 000 metric tons
United Kingdom	394 521 "
United States	149 700 "
France	68 500 "
Belgium	43 700 "
Holland	6 000 "
Austria-Hungary	34 550 "
Italy	11 731 "
Spain	12 000 "
Russia	4 000 "
Japan	4 000 "
Australia	3 000 "
Denmark	2 000 "
Sweden	1 400 "
Others	100 000 "

Consumption. — The world's consumption of the principal fertilizers during 1910, 1911 and 1912 is given in Table II.

TABLE II. — *World's consumption of fertilizers (metric tons).*

	1910	1911	1912
Mineral phosphates	5 500 000	6 000 000	6 500 000
Superphosphates	9 500 000	10 000 000	11 000 000
Basic slag	3 000 000	3 330 000	3 500 000
Peruvian guano	32 000	61 000	83 000
Potash salts	4 039 622	4 353 000	4 520 959
(containing K ₂ O)	(766 200)	(848 705)	(904 000)
Nitrate of soda	2 359 652	2 401 392	2 530 645
Sulphate of ammonia	1 000 000	1 000 000	1 200 000
Synthetic nitrogenous manures	50 000	75 000	150 000
	25 500 000	27 000 000	29 500 000

TABLE IV. — *Intensity of fertilizer consumption in different countries.*

Number	Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption	Order of intensity
		quintals	hectares	qls. p. ha	
1	Germany	59 065 300	35 055 398	1.68	2
2	German colonies			undetermined	7
3	Argentine Republic	6 188	18 775 672	0.003	6
4	Austria	5 451 900	18 422 238	0.29	4
5	Hungary	2 293 100	22 182 718	0.10	4
6	Belgium	5 249 148	1 916 690	2.47	1
7	Brazil	85 219		undetermined	7
8	Bulgaria	3 680	4 840 760	0.0008	6
9	Chile	168 573	2 024 295	0.08	5
10	China	460 361		undetermined	7
11	Cuba	113 500	2 059 111	0.06	7
12	Costa-Rica	3 772	61 480	0.06	7
13	Denmark	1 639 157	2 890 784	0.57	3
14	Ottoman Empire			undetermined	7
15	Cyprus			id.	7
16	Egypt	559 620	3 326 755	0.21	4
17	Ecuador	26		undetermined	7
18	Spain	5 813 203	40 683 000	0.14	4
19	United States . Southern	53 364 500	193 624 639	0.87	3
				0.47	4
				0.0264	5
				0.0456	5
20	Philippine Is.	6 899		undetermined	7
21	Porto Rico			id.	7
22	France	21 161 656	36 798 715	0.58	3
23	Algeria	435 000	3 712 635	0.12	4
24	Tunis	165 900	1 570 000	0.10	4
25	Marocco and Indochina			undetermined	7
26	Other French colonies			id.	7
27- 28	United Kingdom } Great Britain	10 160 000	18 198 590	0.70-0.92	3
		13 120 000			
		2 300 000			
		2 650 000			
29	Australia	2 655 725	4 944 500	0.55	3
30	Canada	320 183	12 756 055	0.03	5
31	Ceylon and Straits Settlements			undetermined	7
32	British India	18 647	90 269 783	0.0002	6
33	West Indies, British Guiana, Bermudas			undetermined	7
34	Mauritius	166 522	75 767	2.19	1
35	New Zealand	2 038 830	16 283 566	0.13	4
36	Union of South Africa	398 560	1 384 548	0.29	4
37	Greece	60 408	1 429 230	0.04	5
38	Guatemala			undetermined	7
39	Italy	11 910 950	20 772 892	0.57	3
40	Eritrea and Italian Somaliland				8
41	Lybia				8
42	Japan	3 707 459	7 694 892	0.48	4
43	Formosa		762 249	undetermined	7

Number	Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption	Order of intensity
		quintals	hectares	qls. p. ha	
44	Luxemburg	312 000	154 832	2.02	1
45	Mexico	46 958		undetermined	7
46	Montenegro				8
47	Nicaragua			undetermined	7
48	Norway	681 173	2 373 276	0.29	4
49	Paraguay			undetermined	7
50	Holland	4 259 220	2 177 642	1.96	2
51	Dutch East Indies	1 000 000	5 152 739	0.20	4
52	» Guiana			undetermined	7
53	» Antilles			<i>id.</i>	7
54	Peru			<i>id.</i>	7
55	Persia				8
56	Portugal	1 528 147	5 037 665	0.36	4
57	Rumania	43 550	7 691 363	0.01	5
58	Russia	5 935 176	99 600 000	0.06	6
59	Finland		2 849 304	undetermined	7
60	Russia in Asia		25 218 627	<i>id.</i>	7
61	Salvador	31 620		<i>id.</i>	7
62	Servia	15 485	1 839 106	0.0084	6
63	Sweden	2 662 868	5 006 272	0.53	4
64	Switzerland	1 186 398	2 234 034	0.53	3
65	Uruguay	25 529	829 934	0.03	5
66	Bolivia			undetermined	7
67	Columbia			<i>id.</i>	7
68	Haiti				8
69	Honduras				8
70	San-Domingo				8
71	Siam				8
72	Venezuela			undetermined	7

As in Table I, the totals are again somewhat too high on account of the mineral phosphates being employed in the manufacture of super-phosphate. The value of the total consumption was below £ 80 million in 1910 and above that figure in 1912.

Table III is a first attempt to determine the intensity of consumption of fertilizers in the different countries. The figures in the last column represent the order of intensity according to the following scheme:

Mean consumption of fertilizers in quintals
per hectare of agricultural land

1	over 2	quintals (180 lbs.	per acre)
2	1 to 2	» (90 to 180	»)
3	0.5 to 1	» (45 to 90	»)
4	0.1 to 0.5	» (9 to 45	»)
5	0.01 to 0.1	» (0.9 to 9	»)
6	less than 0.01	» (0.9	»)
7	undetermined		
8	no data		

An extensive bibliography is appended to the publication, which, in its present (second) edition, forms the starting point for the half-yearly Review (*Revue semestrielle du mouvement international des engrais chimiques*). The publication of this Review was decided upon at the last General Assembly of the Institute (Inst. Int. d'Agr., 4^{ème} Ass. gén., Décis. II, Rapp. Pioda-Laur, 1913) and the first number will appear on September 1, 1914.

606 - **Five Years' Manuring Experiments in East Prussia.** — STUTZER, A. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 258, 236 pp. Berlin, 1914.

The writer, with his collaborators, carried out in the five years 1909 to 1913, 66 field manuring experiments on 15 different estates, and 17 trials of manures for meadows and pastures on several farms. The most important results obtained are the following.

1. *Potash.* — According to the literature on the subject, potash manures are credited with protecting winter cereals and other plants against frost, and this when the potash manures have been spread before sowing and the plants have taken up and elaborated the potash. According to the writer, it is very probable that the effect of potash manures in this direction depends rather upon certain accessory circumstances than upon the plant-food potash itself.

In the experiments, the 40 per cent. potash salt proved better than kainit as a winter top-dressing.

In sowing clover under spring grain (oats or barley), manuring with potash should not be neglected, as it is important for the cereal and still more so for the succeeding clover. In manuring experiments on permanent pastures and meadows, potash manures have proved especially necessary.

2. *Nitrogen.* — The experiments have confirmed the observation that dunged manure which received nitrate of soda as well as potash and phosphoric acid made much better use of the potash in the manure and in the soil, and also of the nitrogen in the farmyard manure.

Further experience has been gained as to the good effects of the nitrogen in nitrate of lime.

The effect of cyanamide in these experiments was considerably inferior to that of nitrate of soda or of nitrate of lime. The troublesome dust produced by cyanamide when broadcasted could be avoided by mixing with it 10 to 15 per cent. of iron pan. This also improves its action, as the presence of iron oxide assists in the transformation of cyanamide into urea. This mixture as a top-dressing for winter grain gave an increase in the yield and a better utilization of the nitrogen, viz. from 48 to 62, 29 to 59, 37 to 78, 49 to 87, 42 to 57 and 46 to 64 (as percentages) in the various experiments.

Cyanamide freed from carbide by treatment with steam gave a higher yield of grain than ordinary cyanamide in field trials with oats. The same result was obtained by adding organic substances to cyanamide.

Sulphate of ammonia obtained by Haber's process (combination of atmospheric nitrogen with hydrogen to form ammonia) proved equal in field trials to the product of coke and gas works.

The writer has also made observations on the action of a combined dressing of sulphate of ammonia and rock-salt on sugar beets in a very good year and a very bad year. In the good year this mixture gave decidedly better results than nitrate of soda; in the bad year the weather was very dry till the end of June and the beets developed very late: the result was that the amount of sugar produced on a given area was greater on the nitrate of soda plot.

Among new manures, urea obtained from atmospheric nitrogen, and nitrate of urea, gave good results; their value was determined partly in field trials and partly in pot cultures. The urea used contained 43 to 44 per cent. of nitrogen, the nitrate of urea 33.60 per cent. In the pot cultures in the summer of 1913 oats were used; out of 100 parts of nitrogen supplied as manure, the following were recovered in the crop:

Manuring	Soil used	
	Loam	Peat soil
Nitrate of soda	80.5	80.5
Urea	83.5	88.5
Nitrate of urea	94.5	77.0

In experiments with tobacco, nitrate of urea beat all other nitrogenous manures.

Three other compounds built up from atmospheric nitrogen, *viz.* calcium nitrite, aluminium-nitrogen and silicon-nitrogen, turned out to be of little value or quite useless.

In experiments on permanent pastures and meadows, small dressings of nitrogen have sometimes given highly satisfactory results; but it is not yet clear under what soil conditions such manuring is likely to be successful.

Stimulants (catalytic manures) have also been tried: mixtures of manures with various metallic oxides and salts of metals have sometimes given good results, sometimes none. It appears that different plants behave differently towards these bodies.

607 — **Comparative Effects of Nitrate of Soda and Nitrate of Lime** (1). — CHATEAUCLOS, R. in *Journal d'Agriculture pratique*, Year 78, No. 22, pp. 688-690. Paris, May 28, 1914.

Good results were obtained by using nitrate of lime on certain sandy and granitic soils poor in lime in the departments of Vienne and Haute Vienne.

608 — **The Manufacture of Calcium Cyanamide in Dalmatia** (1). — *Landes-Ans-blatt des Erzherzogthumes Osterreich u. d. Enns*, Year 10, No. 9, pp. 69-70. Vienna, 1914.

The manufacture of calcium cyanamide, which is making such great progress in all parts of the world (2) has of late become established also in

(1) Cf. article: "The Use of Artificial Nitrogenous Manures in Austria" by F. W. DAFERT, in *B.* Dec. 1912, pp. 2547-2550.

(2) The estimated output of the world for 1913-1914 was 27 500 tons.

Dalmatia. The cyanamide factories which have been erected in that country derive their power from the falls of the Kerka near Sebenico and of the Cetina near Almissa, not far from Spalato. When completed, the factory at Almissa will produce about $2\frac{1}{2}$ times as much as the one at Sebenico. The falls of the Cetina are not inconsiderable, and the driving power developed by the force of the water is thus fairly high; when the works are completed, there will be annually available about 80 000 HP.

609 - Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria. — KÖCK, G., in *Monatshefte für Landwirtschaft*, Year VII, Part 1-2, pp. 24-27. Vienna, January-February 1914.

The Vienna Phytopathological Station has carried out, on its experimental grounds in various parts of Austria, experiments in the inoculation of seed with nodule bacteria. The experiments were carried out with serradella, beans, and lupins.

In one case serradella gave the greatest yield of green forage after treatment with Azotogen (1) while in two others Nitragin (2) was the most effective, Azotogen having very little influence. In one experiment Nitragin gave a yield of green food $2\frac{1}{2}$ times, and Azotogen twice, as large as that produced by the untreated area. The yield of seed was also, roughly speaking, doubled by the use of either agent as compared with the untreated area. The nodule bacteria from the Institute of Agricultural Botany at Munich also exercised a remarkably beneficial influence on the yield. No influence was observable, as a result of these experiments, from the inoculation on leguminous plants raised the following year on the same land.

With beans and blue lupins no noteworthy results were in either case to be recorded, while in another experiment, part of the blue lupins shewed a considerably increased yield. In this same experiment white lupins did not respond at all to the application of various bacterial cultures.

It is, of course, impossible to generalize from the results obtained, without taking into account the nature of the soil and of the plants grown. Trials on his own land can alone afford the farmer conclusive information as to the economic value of this kind of treatment as applied to the various leguminous crops.

610 - Composition of Various Starches. — TANRET, C. in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 158, No. 19, pp. 1353-1356. Paris, May 11, 1914.

The writer observed that all starches contain amylopectin and various amyloses in different proportions. They may also be distinguished from one another by the effect of water on the amylopectin and by the solubility of the amyloses in hot water. Analytical methods are discussed and the composition of various starches is given as follows:

(1) Azotogen cultures supplied by HUMAN and TEISLER, of Dohna.

(2) Nitragin cultures supplied by A. KÜHN's Agricultural Works, Bonn-on-Rhine.

Amylopectin and amylose content of various starches.

Starch	Amylopectin	Amylose	Starch	Amylopectin	Amylose
Oats	71.5	28.5	Maize	70	30
Banana	79.5	20.5	Barley	73	27
Wh. at.	67.5	32.5	Pea	78.5	21.5
Chestnut	67	33	Apple	76	24
Broad beans	72	28	Rice	68.5	31.5
Horse beans	76	24	Buckwheat	78.5	21.5
Haricot beans . . .	75.5	24.5	Rye	78.5	21.5
Lentil	73.5	26.5	Potato	73	27

611 - **The Determination of the Quality of Starch in Rice Grains.** - WARTH, F. J. and DARABSETT, D. B. - 1. Disintegration of Rice Grains by means of Alkali, in *Agricultural Research Institute, Pusa, Bulletin* No. 38, pp. 1-9, + plates I-VI. - 2. The Fractional Liquefaction of Rice Starch, in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 5, pp. 135-146, + 1 plate. Calcutta, February 1914.

I. Chemical analysis reveals no differences in composition between different varieties of rice such as would account for their differences in hardness, milkiness, and milling qualities. With the object of devising some method of distinguishing the quality of the starch, rather than its quantity, in different types of grain, these investigations on the disintegration of rice grains by means of alkali were commenced. Rice grains immersed in dilute solutions (one per cent.) of alkali show disintegration in a few hours owing to the solution of the protein constituent. At concentrations of alkali of 2 and 3 per cent. the starch granules are attacked and the whole of the grain becomes gelatinised. It was found that the degree of milling or polishing has no effect on the rate of disintegration, but that different varieties show considerable differences.

II. After a series of comparative trials, it was found that immersion in a 1 per cent. solution of potassium hydrate for 24 hours produced satisfactory results without causing appreciable breakage of the starch granules. Various samples of rice were disintegrated in this way, and, after neutralisation, were subjected to fractional liquefaction by conversion of the starch with malt extract at different temperatures. After conversion the solutions were filtered with kaolin to remove the unliquefied granules. The liquefied starch was estimated in an aliquot portion of the filtrate by hydrolysis with hydrochloric acid, the glucose content being determined by Fehling solution using permanganate for estimating the cuprous oxide. The quantities of permanganate required are proportional to the amounts of starch liquefied at a given temperature, and may be used in comparing the qualities of the starch of the different varieties of grains.

The results obtained with various samples of rice are as follows :

1) Glutinous rices contain starch which liquefies appreciably at 60° C. and is almost completely liquefied at 70° C.

2) Hard vitreous rices do not begin to liquefy to any appreciable extent before 65° C. and reach completion at about 75° C. A sudden breakdown of starch takes place between 70° and 75° C.

3) In almost all types of rice there is a residue of 7 or 8 per cent. of more resistant starch which only breaks down gradually.

From these results it appears that the cooking quality of rice is distinctly correlated with its starch quality. Comparisons of the rate of disintegration in alkaline solution show that there exists some correlation between disintegration and starch quality. Further work is necessary to determine the exact relationship between protein content, rate of disintegration and starch quality.

612 - **The Movement of Potash in Plant Tissues.** — MAQUENNE, L. and DEMOUSSY, E. in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 158, No. 20, pp. 1400-1404. Paris, May 18, 1914.

Branches of various plants were subjected to electrolysis in a jar containing distilled water in order to dissociate ionisable compounds. The cathode liquid was then examined: more than four-fifths of its contents consisted of potash. The anode liquid on the other hand contained traces of phosphoric acid, and smaller traces still of sulphuric and hydrochloric acids.

613 - **The Action of Manganese on Plant Growth.** — 1. KELLEY, W. P. (The Function of Manganese in Plants) in *The Botanical Gazette*, Vol. LVII, No. 3, pp. 211-227. Chicago, March 1914. — 2. SKINNER, J. J. and SULLIVAN, M. X. (The Action of Manganese in Soils) in *Bulletin of the U. S. Department of Agriculture*, No. 42, *Contribution from the Bureau of Soils*. Washington, April 3, 1914.

Previous experiments on the effect of manganese on plant growth show very variable results. Two views have been put forward to account for the observed effects, viz. a) the stimulation of the activity of oxidising enzymes in soils and plant tissues; and b) the increased solubility of the mineral constituents of soils. The inadequacy of these views to account for all the facts has led to the present investigations.

1. — *The function of manganese in plants.*

The writer has studied the effect of manganese on plant tissues microscopically and chemically. He finds that changes take place in the protoplasmic contents of the cells of the roots and leaves. Occasionally the protoplasm contracts from the cell walls and the nuclei become brown. In some plants (pineapple) the chlorophyll undergoes decomposition and starch formation ceases. This action is shown to be independent of the activity of the oxidising enzymes. The ash analyses of numerous plants show that manganese is absorbed in considerable quantities, that the ratio of lime to magnesia is increased and that the percentage of phosphoric acid is decreased.

From these results, the writer is led to suggest that manganese affects the permeability of the protoplasm to calcium and magnesium salts and that the consequent change in the rate of absorption of these salts may react beneficially or otherwise according as the ratio of lime to magnesia in the soil is less or greater than that required for maximum growth.

2. — *The action of manganese in soils.*

Experiments were carried out to study the effect on growing crops of adding manganese salts to soils and to water cultures containing aqueous

extracts of soils. The effect in the oxidation of the soil of plots containing growing crops was also determined. The results obtained are summarised as follows :

a) Manganese chloride, sulphate, nitrate, carbonate and dioxide have a stimulating effect when applied to unproductive sandy loam soil. The best results were obtained when the salts were applied in amounts of from 5 to 50 parts of manganese per million.

b) On a productive loam the various salts of manganese had no stimulating effect.

c) The effect of manganese on the oxidising power of the roots and on the general growth of plants growing in aqueous extracts of soils varies with different soils. With poor, unproductive soils, especially those containing harmful organic compounds, the addition of manganese increased oxidation and growth. With productive soils, oxidation was increased but the growth was decreased, probably owing to excessive oxidation.

d) On soils of an acid nature the addition of manganese decreased the oxidising power of the soil and plants as well as the crop production.

e) The oxidising power of a soil depends not so much on the amount of manganese as on its form, and on the nature of the organic matter. Organic matter in a state of autoxidation increases the oxidising action of manganese.

The writers suggest that the beneficial action of manganese in certain soils may be due to its function of aiding and increasing the oxidation and other vital processes in the plant as well as in the soil, and by this means changing or destroying some noxious products detrimental to plant growth.

614 - **Action of Thorium on Seeds.** — MUÑOZ DEL CASTILLO, JOSÉ (Lecture before the Spanish Farmers' Association) in *Boletín de la Asociación de Agricultores de España*, No. 58, pp. 50-56. Madrid, March 1914.

Since 1912, the Radiological Institute of Madrid University has undertaken a series of investigations into the action of radium, thorium, and radioactive manures. By this means it has been confirmed that with regard to increasing the growing-power of seeds, the action of thorium is superior to that of radium as regards cereals and other food-plants, and that plants grown from seed subjected to thorium-radiation possess a stronger growth.

The most complete investigations were made with barley, the seed being placed in two earthenware pots filled with ordinary earth. In one of the pots small particles of thorium ore had been placed beforehand; the other pot acted as a control. From the seed produced by the pot containing the thorium, other cultures were started in two more pots, one filled with ordinary earth, and the other with similar earth containing thorium ore. The result, which the writer illustrates by means of photographs and a diagram, was as follows: the third generation of barley exposed to the action of the thorium had the leaves so highly developed that it looked like a new variety.

The writer observes that there are plenty of soils possessing radio-activity on account of thorium emanations, and that they ought to be used particularly for seed production. Analysis of soils to determine the presence of this property would therefore be useful.

- 615 - **Breeding Experiments which Show that Hybridisation and Mutation are Independent Phenomena.** — GATES, R. R. in *Zeitschrift für Induktive Abstammungs und Vererbungslehre*, Vol. II, Part 4, pp. 209-278, + 25 figs. (article written in English). Berlin, March 1914.

PLANT
BREEDING.

Hybridisation experiments between *Oenothera rubricalyx* and *O. grandiflora* give results which cannot be interpreted in terms of Mendelian unit-characters. The red pigmentation characteristic of *rubricalyx* is dominant in F_1 and shows segregation in F_2 , but the ratios of pigmented to unpigmented offspring were different in different families. It is therefore concluded that different F_1 individuals possess different degrees of prepotency as regards the percentage of pigmented plants in their offspring. Crossing back the F_1 with either parent produced offspring of a darker or lighter shade respectively, showing that the amount of pigment produced by the individual cells is quantitatively inherited.

The characters for height were inherited according to the ratio 3 tall: 1 dwarf in one family and 1 tall: 2 dwarf in another. When the reciprocal cross was made the ratio was 7:1. These results can only be accounted for by assuming different degrees of prepotency in different F_1 individuals.

The numerous differences in foliage, buds, pubescence and in physiological development between *grandiflora* and *rubricalyx* are non-Mendelian or blending characters. In all these cases there is neither dominance nor segregation, but every conceivable degree of intermediacy is represented.

From these and other results the writer concludes that the Mendelian conception of fixed and unmodifiable unit characters which can be redistributed and shuffled regardless of the organisms themselves which exhibit these characters, is unsound, for the individual organism is the real unit. The presence-absence hypothesis implies a misconception of the nature of the differences between alternative characters, and of their interactions with each other.

Various mutants and aberrant forms occurred among the above hybrids. One of these, known as *lata rubricalyx*, was examined cytologically and was found to contain 15 instead of the usual 14 chromosomes. This work will be described elsewhere.

- 616 - **A Case of Correlation in Wheat.** — PARKER, W. H. in *Journal of Agricultural Science*, Vol. VI, Part II, pp. 179-181. Cambridge, May 1914.

In investigating the variation of the density of ear in a variety of wheat (Squarehead's Master) a striking case of correlation was observed between the average length of internode of the ear and its total length. The average internode-length is obtained by dividing the total length of rachis in millimetres by the total number of internodes. Measurements were made of the main tiller of 1887 plants and the calculated correlation coefficient

proved to be 0.9099. Considering the very small deviation of the actual internode-lengths compared with those estimated, the use of the more easily determined total rachis-length as a measure of the density of ear would appear to be justifiable. The writer also considers that the relation between internode-length and rachis-length would be a more satisfactory basis for the classification of wheats according to the density of their ears, than that of the internode-length as used by NILSSON-EHLE, or the method of grouping them into classes by eye alone as is done at Svalöf.

617 — **Rice Breeding in Java** (1). — VAN BREDA DE HAAN, J. in *Bulletin économique de l'Indochine*, Year 16, No. 100, pp. 11-28. Hanoi, January-February 1913.

6400 samples of paddy were collected from various parts of Java for trial at the "Research Laboratory for Rice and Other Crops." They were first separated into two divisions by staining sections of the grains with dilute iodine solution, which turns *Oriza sativa* a dark violet and *O. glutinosa* a red brown. They were further subdivided under the following headings: 1) dark glumes and awns; 2) red awns; 3) yellow awns and 4) awnless, and in each division the varieties were classed according to the colour of the grain and the length of the awn. In this way 715 groups were established for *O. sativa* and 41 for *O. glutinosa* and each group was provided with a genealogical register on which the external characters of the group were entered, particular note being taken of the appearance of hairs on the nodes and of the size and surface of the ligule.

The more promising varieties were subjected to pedigree culture with good results, and under these conditions a yield of 76 pikols per bouw (5900 lbs. per acre) was obtained from Tangerang rice, which was imported from Carolina fifty years ago. In order to extend these results to other conditions of soil, climate and irrigation, it is proposed to establish seed gardens in other parts of the Island.

Hybridisation experiments are also being carried on, but good results are reached more slowly than with the method of selecting and breeding pure lines, on account of the difficulty of isolating constant types.

At Buitenzorg rice flowers open from 6 a. m. to 3 p. m., being most active from 10 a. m. to noon. The flowers on a panicle do not all open at the same time: in fact a panicle may take up to six or ten days to open all its flowers.

In the course of the experiments, it was found that the heaviest grains are usually situated in the uppermost third of the panicle, that the heaviest grains could not be detected with certainty by the immersion method and that density of grains used as a factor in selection gave very irregular results.

618 — **Tobacco Breeding in Java.** — HONING, J. A. in *Mededeelingen van het Delt Proefstation te Medan*, Year VIII, No. 5, pp. 135-153. Medan, March 1914.

An account is given of tobacco breeding in the two centres of production in Java, — Djember and Klaten.

At Djember tobacco is cultivated up to an altitude of 1800 ft., and a

(1) See also No. 27, *B.* Jan. 1913; No. 120, *B.* Feb. 1913.

(Ed.).

large number of varieties are required to fit the changing climatic conditions. The most popular variety comes from Deli, but this is not sufficiently hardy to be cultivated above 200 to 300 ft. and has to be replaced by a Kadoe variety, which is more resistant but of inferior quality. By crossing the two varieties, a hybrid has been obtained possessing the good qualities of both parents; crosses of a Japanese variety, Hatano, with the Kadoe variety have also yielded hybrids but of inferior quality.

The breeding work has hitherto been done by the planters themselves; they raise fresh hybrids every year employing native women to carry out the manual labour. Recently an experimental station has been created which will take charge of the breeding work and attempt to isolate a suitable type of plant instead of having to raise hybrids every year.

At Klaten the experimental stations have chiefly sought to improve tobacco by selection. Several cultivated varieties were investigated and two types known as the Y and the Kanari were isolated and gave very satisfactory results; unfortunately their very uniformity proved a disadvantage on the market accustomed to a more varied product, and experiments, are now being made to produce varieties which will comply more fully with the market requirements.

619 - Impurities in Seeds in Victoria, Australia. — *Communicated by S.S. CAMERON, Director of Agriculture.*

AGRICULTURE
SEEDS

Report on seed examined in March 1914.

Variety of seed	Country of origin	Weed seeds		Percentage of non-germinable seed	Percentage of diseased seeds	Quantity examined	Remarks
		Species	Percentage				
Millet Seed (<i>Panicum</i> sp.)	Turkey	Nil	Nil	.8	Nil	3 oz.	A small percentage of grit and loading. This has been imported for birds' food.

620 - Effect of Low Winter Temperatures during 1913-1914 on Wheat in the Ardennes. — *DENAÏFFE in Journal d'Agriculture Pratique, Year 78, No. 20, pp. 620-621. Paris, May 14, 1914.*

CEREAL AND
PULSE CROPS

A large number of varieties of wheat growing in the experimental fields of Carignan (French Ardennes) were exposed to very low temperatures during the winter 1913-1914. From December 27 to January 10 the plants were protected by a covering of snow, but from January 10 to 19 they were exposed to temperatures of -18° to -20° C. (0° to -4° F.) without a single thaw. The proportion of plants destroyed by the frost was recorded and varied from 0 to 80 per cent.

621 - **Manurial Experiments on Malting Barley carried out at the Vienna Experimental Station.** — DAFERT, F. W. in *Monatshfte für Landwirtschaft*, Year VII, Nos. 1-2 and 3-4, pp. 5-19 and 50-58. Vienna, January-February and March-April 1914.

In 1906 manurial experiments were carried out with malting barley at the Vienna Experimental Station in order to determine the effect of application of phosphoric acid on the yield and quality of the grain. The experiments consisted of a series of 46 trials, in which plots were dressed with superphosphate at the rate of 180 lbs. per acre; all plots were duplicated. The average results were as follows:

Plot	Mean of 46 trials		Mean of 27 trials	
	Grain in lbs. p. acre	Increase due to manure, lbs. p. acre	Percentage of nitrogen in grain	Difference between manured and unmanured grain
Unmanured	1 919	—	9.38	—
Superphosphate	2 044	125	9.44	+ 0.06

The application of superphosphate produced no very marked influence on the yield, while the difference in nitrogen content between the manured and unmanured grain was less than that between the seed and the harvested grain, which was estimated in 28 trials and amounted to 0.61 per cent., showing that climatic conditions are more important than manurial treatment with regard to the composition of the grain. When the barleys obtained were grouped according to the phosphoric acid content of the soils in which they had been grown, the following results were obtained:

No. of trials	Percentage of phosphoric acid in soil	Increase in crop due to superphosphate, lbs. per acre
5	over 0.2	145
9	0.15 to 0.2	123
21	under 0.15	79

These results are unexpected, inasmuch as the soils richest in phosphoric acid have apparently profited most by the dressing of superphosphate. Similar results have already been obtained in other places, but they cannot be considered as generally applicable.

622 - **Influence of Potash and Phosphoric Acid on the Quality of Malting Barley.** — SCHÜL, L., in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 5, pp. 641-712. Berlin, 1913 (Published January 15, 1914).

The experiments here described were made by the writer on the experimental ground of the Agricultural Institute at Giessen University in 1909. The soil is a fairly strong loam, is drained, and stands at 500 ft.; the average rainfall is 550 mm. (22 in.); the previous crop was winter wheat.

The subject of the experiment was a barley of the Imperial type, called New Burton Malting. The barley was drilled in on the 10th of April, in rows 9 in. apart. On the 26th and 27th of April a mixed potassic and phosphatic dressing was applied. To ascertain whether the substances under investigation were present in the minimum amounts required by the crop they were applied in three progressively increasing quantities:

	40 per cent potash salts	Superphosphate (18% water-soluble phosphoric acid).
	cwt. per acre	cwt. per acre
Light dressing	0.4	0.8
Medium "	0.8	1.6
Heavy "	1.6	3.2

By combining the above quantities, fifteen different dressings were obtained.

- 3 potash alone: light, medium, and heavy.
- 3 phosphates alone: " " "
- 3 combining a light potash dressing with each of the 3 strengths of phosphates.
- 3 " " medium " " " " " " " "
- 3 " " heavy " " " " " " " "

In addition, there were 5 plots with no manure, and the whole was run in duplicate, making a total of 40 plots, each measuring 12 sq. yds. To ensure the action of the potash and of the phosphoric acid, a dressing of 2.4 cwt. of nitrate of soda was applied to the manured plots on the 30th of April. All the manures were hoed in and the plots raked over. The whole experimental area had been limed with 16 cwt. per acre of 96 per cent ground quicklime.

The weather began by being cool in April, was finer and warmer in May, then became cool and wet for the first three weeks of June, but the temperature reached summer level for the last ten days; July, however, was cool and rainy, and heavy rain at the end of the month lodged some of the barley. The crop was harvested dead-ripe on the 14th of August. No definite statement can be made as to any difference in the ripeness of the various plots, but the results of analysis seem to point to there having been such a variation.

The corn was threshed and the yield ascertained on the 18th and 19th of August. The judging of the quality, which was not carried out till June 1910, had reference to: protein and water content, weight of grain, evenness of the sample, fineness of the husk, colour, germinating capacity and energy, impurities, damaged grain, sprouted grain, foul odour.

The writer obtained the following results:

1. In every case the soil profited by a phosphatic dressing, which caused a fuller utilization of nitrogen and potash. A quite remarkable demand for potash was observed to be brought about by the medium and strong dressings of phosphates.

2. The potash-phosphate dressings always effected an increase in the gross yield.

3. The use of 40 per cent. potash salts and of superphosphates as a top-dressing proved suitable.

4. The protein-content, which was very high on account of the nitrogenous dressing, was decreased by the application of combined potash and phosphates and this decrease corresponded to the increase in the yield.

5. The proportion of dry matter shows a nearly regular increase with the use of combined potash and phosphates, independently of the yield. It was not possible to find out whether this is due solely to a more advanced stage of ripeness, owing to the better nourishment of the barley, or to a larger deposit of potash and of phosphoric acid in the grain. In cases where no increase in yield was found on plots with heavy potash dressings and phosphoric acid, as compared with those with moderate potash dressings, a superfluous consumption of potash is to be assumed.

6. Not regularly, but still in the majority of cases, the double dressing gives an increase in 1000-grains weight and in the size of the grains, and a decrease in the proportion of husk.

7. Increase of the 1000-grains weight is generally accompanied by increase in the number of grains which will not pass through a 2.8 and a 2.5 mm. sieve. The weight of husk varies inversely.

8. Combined potash and phosphate manuring improves appreciably the germinating capacity and more still the germination energy.

9. Barley dressed with potash and phosphoric acid has nearly always a canary-yellow colour.

The writer concludes that in order to obtain a high-class sample, nitrogen should be present in as small a proportion as possible. If a maximum yield and the highest quality are incompatible, it is none the less possible, up to certain point, to obtain by means of a nitrogenous manuring an increase in yield without injuring the quality. The attainment of this point depends essentially on the quantity of potash and phosphoric acid employed. In discussing his results the writer quotes those obtained by several other investigators.

FORAGE CROPS.
MEADOWS
AND PASTURES

623 — Argentine Lucerne Seed. — Dirección General de Agricultura y Defensa Agrícola, Boletín del Ministerio de Agricultura, Vol. XVII, No. 1, pp. 82-89 + 3 coloured plates. Buenos Aires, 1914.

At the present time, Argentina produces all the seed necessary for her great crops of lucerne, and will be able, at no distant date, to become an exporter. The quality, however, does not correspond to the increase in quantity, since the seed leaves a great deal to be desired in the way of purity, absence of dodder and germinating capacity. But on the other hand the native seed gives more hardy and lasting plants than any imported variety.

The seed from the irrigated districts of Mendoza, San Juan, La Rioja, part of San Luis, north of Córdoba, Salta, Jujuy and Catamarca, generally contains a large amount of dodder (*Cuscuta corymbosa* R. et P. and a variety of *C. racemosa* Mart.) and seeds of *Melilotus parviflorus* Desf., and sometimes

a large quantity of *Lippia nodiflora* Rich., *Schkuhria bonariensis* Hook., *Bidens leucanthus* Wold., *B. scabiosoides* H. et Arn., *Panicum colonum* L., *Chenopodium opolifolium* Schr., *Madiola latoritia* Schm., *M. malvifolia* Gr., *Anoda triangularis* Db., and *Sida rhombifolia* L. The seeds of this last species constitute, together with those of dodder and melilot, a real menace to farming. *Sida*, being perennial, is difficult to destroy.

Another serious drawback to native seeds is the presence of hard grains, 50 per cent on an average, only half of which are capable of germinating, the other half being pure loss.

In a second area, comprising the south of Córdoba, part of San Luis, the north of the Pampa, the west and north-west of Buenos-Aires and the department of San Rafael de Mendoza, the seeds of lucerne are less well developed, and in some cases, as at San Luis, very small indeed, although well shaped. In this area there is less dodder, but there are usually several other extraneous seeds: *Chenopodium*, *Amaranthus*, *Cnicus*, *Centaurea*, *Anthemis*, *Plantago*, *Rumex*, etc. Hard seeds occur in a proportion of 25 per cent. The germinating capacity is undoubtedly superior and the plants produced last a long time and resist drought well.

To the third area belong the south of Buenos-Aires, Rio-Negro and Chubut. The seeds from there are fairly popular, both on account of their size and on account of the small quantity of extraneous seeds present. There are, however, 50 per cent. of hard seeds in the two latter provinces, and 30 per cent. in that of Buenos Aires. Dodder is not often found.

To sum up, it may be said that Argentine lucerne seed grown without irrigation surpasses in germinating capacity all the foreign varieties of lucerne, but that it has nevertheless the following faults:

1. It is impossible to obtain large quantities of good seed of even quality.

2. A large proportion of the native seed is so impure that diligent cleaning would be required before it could be sown; but this cleaning cannot be effected, owing to the small difference in price between good and bad seed, and because purchasers prefer a low price without troubling about quality.

3. A large quantity is found of the seeds of *Cuscuta racemosa* Mart., and of *C. corymbosa* R. and P., the size of which makes it impossible to separate them from the lucerne seed.

4. A large quantity of hard seeds are present; these cause a considerable reduction in the germinating capacity and energy.

To obviate these faults, it would be necessary: 1) for the producers to eradicate weeds in the lucerne fields, abandoning those fields which cannot be cleaned; 2) for the purchasers to pay attention to buying good, well-cleaned samples of seed instead of seeds offered at a low price.

624 - Determination of Certain Species of *Carex* by their Vegetative Characters. — KUSNEZOV, W. in *Bulletin für angewandte Botanik*, Year 7, No. 1 (65), pp. 18-41 + 10 plates. St. Petersburg, January 1914.

The writer has prepared the following schemes for the determination of species of *Carex*.

A. Determination of the ten chief species of Carex growing in swamp-meadows by field examination of the vegetative parts.

1. The plants form dense or more or less open clumps 2
Plants with creeping stems, not forming clumps 6
2. Very open clumps, not forming tussocks. 3
Dense clumps, forming more or less well-developed tussocks 4
3. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network
C. paludosa Good.
Membrane of the leaf-sheath veinless, not wearing to a network *C. acuta* L.
4. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network
C. stricta Good.
Membrane of the leaf-sheath veinless, not wearing to a network 5
5. Cross-section of upper part of leaf-blade showing reflexed margins . . . *C. vulgaris* Fries.
Cross-section of upper part of leaf-blade semicircular or channeled without reflexed margins *C. paradoxa* Willd.
6. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . 7
All three sides of the leaf-sheath thick, foliaceous, green *C. disticha* Huds.
7. Membrane of the leaf-sheath veined, wearing to a filamentous network 8
Membrane of the leaf-sheath veinless, not wearing to a network 9
8. Leaves soft, whitish within *C. ampullacea* Good.
Leaves rigid, bright green within *C. vesicaria* L.
9. Plant greyish-green or bluish-green *C. panicea* L.
Plant green or yellowish-green *C. teretiuscula* Good.

B. Determination of the ten chief species of Carex growing in swamp-meadows by examination of the vegetative parts in hay.

1. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . . 2
All the sides of the leaf-sheath thick, foliaceous, green *C. disticha* Huds.
2. Membrane of the leaf-sheath veined, wearing to a filamentous network 3
Membrane of the leaf-sheath veinless, not wearing to a network 6
3. Leaf-blade soft, whitish within *C. ampullacea* Good.
Leaf-blade stiff, green or greyish-green within 4
4. Leaf-blade bluish-green below *C. paludosa* Good.
Leaf-blade greyish-green or light green below 5
5. Leaf-sheath tinged with reddish *C. vesicaria* L.
Leaf-sheath light or dark brown *C. stricta* Good.
6. Cross-section of leaf-blade channeled, the central and upper parts with reflexed margins 7
Cross-section of leaf-blade channeled or semicircular, without reflexed margins . . . 9
7. Leaf-blade bluish-grey-green or bluish-grey *C. panicea* L.
Leaf-blade green, greyish-green or yellowish-green, not blue grey 8
8. Upper part of leaf-blade with slightly reflexed margins *C. acuta* L.
Upper part of leaf-blade with strongly reflexed margins *C. vulgaris* Fries.
9. Ligule continuous with the top of the leaf-sheath membrane, the two forming a collar round the stem or the shoot *C. teretiuscula* Good.
Ligule distinct from the leaf-sheath membrane, not forming a collar *C. paradoxa* Willd.

625 - **Large Scale Field Trials with Mangels.** — VON RÜMKE, K., and ALEXANDROVICH, J., in *Landwirtschaftliche Jahrbücher*, Vol XLV, Part 4, pp. 503-596 + 6 figs. Berlin, December 23, 1913.

In 1912 the writers carried out field trials on a large scale in collaboration with R. Leidner, K. Schröter and O. Bormann, with 35 different varieties of mangels. Six plots were devoted to each variety and the seed was drilled in. The yield, percentage of dry matter, and sugar-content were ascertained, and a description of the quality and quantity was given in the report. In working out the results, experimental errors were reduced by algebraic compensation.

On completion of the experiments, the writers make suggestions for the profitable carrying out of large scale field trials. The object of the investigations is to classify more exactly, according to quality and quantity, the numerous varieties on the market. The more direct testing of each individual variety composing a group which the large scale field trials seem to point to as suitable for certain conditions, must be left to the farmer. Trials covering one year only, but embracing a wide variety of soils and climates, carried out in different districts and repeated periodically, are more satisfactory than large scale trials lasting over several years in the same district, especially on account of the greater rapidity with which information can be obtained by the former method.

626 - **Studies in Indian Cottons. Part I: the Vegetative Characters.** — LEAKE, H. MARTIN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VI, No. 4, pp. 115-151, + 3 maps + 9 plates. Calcutta, February 1914.

FIBRE CR

Studies of the vegetative characters of Indian Cottons have been in progress in the United Provinces since 1905.

As a result of these and other studies of various herbarium collections the writer classifies the various types as follows.

MONOPODIAL.

Perennial; secondary branches ascending sharply at an acute angle. Leaf factor (1) less than 2; plant almost glabrous. Bracteoles small, triangular; margin entire or dentate. Corolla yellow.

Gossypium obtusifolium (Roxburgh *Flora Indica*) Gammie and Watt Type 1.

Perennial; secondary branches spreading. Leaf factor less than 2. Stem and leaves densely covered with short hairs. Bracteoles deeply auriculate or reniform, deeply serrate, spreading in fruit. Corolla yellow, petals small. Stigma heavily glandular. Capsule inflated and nearly spherical with a sharp mucronate apex.

G. herbaceum (Linn.) Todaro and Gammie, and *G. obtusifolium* var. *Wightiana* Watt Type 2.

(1) It may be defined as the ratio of the length of the middle lobe to its greatest breadth. For explanation see *Journal of Genetics*, Vol. I, No. 3, pp. 220. (Ed.).

Perennial "tree cotton"; secondary branches ascending sharply at an acute angle. Entire plant deep red or purple. Leaf factor greater than 3; frequently an extra tooth on one or both sides of the central lobe. Bracteoles small, triangular; margins entire or with the tip dentate. Corolla deep red. Stigma eglandular. Capsule usually 3-celled, ovate.

G. arboreum (Linn. sp. Pl.) Parlatores and Todaro, and *G. arboreum* Gammie and Watt Type 3.

Plant tall with long monopodial branches sharply ascending. Leaf factor greater than 3; leaf wrinkled. Leaf and stem covered with short hairs. Bracteoles triangular with margin dentate. Flowers yellow or white.

The commonest form of this group possesses the habit and shape of bracts of Type 3, with the wrinkled leaf and short hairs of Type 2. It comprises the *G. intermedium* of Gammie.

SYMPODIAL.

Annuals with few or none of the lowest secondary branches monopodia, the remainder sympodia; monopodial branches ascending and sympodial spreading.

Plant tall, drooping later under the weight of fruit. Leaf large, factor less than 2; lobes 3 or with 2 small accessory basal lobes. Young stem and leaves sparsely hairy. Bracteoles small, entire or with few small apical teeth, closely enveloping bud and fruit. Corolla yellow with deep red "eye". Petals large, semi-transparent. Stigma eglandular or with few glands only. Capsule 3-celled ovate.

G. indicum (Lamk.) Gammie, and *G. Nanking* var. *bani* Watt. Type 4.

Plant erect, drooping later. Leaf factor less than 2; lobes 5-7. Young stem and leaves hairy. Bracteoles large, entire or with a few small apical teeth, loosely enveloping bud and in fruit sometimes reflexed. Corolla yellow with deep red "eye"; petals opaque. Stigma eglandular, or few glands only. Capsule 3-4 celled, ovate. Type 5.

Plant erect, differing from Type 4 in greater rigidity of main stem and greater angle at which secondary monopodia arise (about 45°), and in the white corolla. Petals small, scarcely projecting beyond the bracteoles Type 6.

Plant erect, secondary branching monopodial, when developed, sharply ascending. Leaf factor less than 2; flower white. The plant is strongly asymmetrical and the vegetative period very brief, the first flowers developing while the plant is quite small. Growth continues throughout the season, the plant maintaining a marvellous fertility. Type 7.

Plant tall, drooping later. Leaf factor greater than 3; lobes 5-7 with an extra tooth on one or both sides of the central lobe frequently developed. Young stem and leaves hairy. Bracteoles entire or with few apical teeth. Corolla yellow with deep red "eye". Stigma eglandular or with few glands only. Capsule 3-4 celled, ovate. Type 8.

Plant differing from above only in the colour of corolla which is white and scarcely protrudes beyond the bracteoles. Type 9.

Types 4-9 belong to the *G. neglectum* and *G. roseum* of Todaro, the *G. neglectum* (Tod.) of Gammie and the *G. arboreum* vars. *neglecta* and *rosea* of Watt.

Plant tall with main stem weak and early drooping. Leaf factor greater than 3; lobes 5-7. Bracteoles entire or with few apical teeth, large and continuing to grow with the developing boll. Corolla pale yellow with deep "eye". Stigma eglandular. Capsule ovate, very large with numerous seeds. *G. cernuum* of Todaro and Gammie and *G. arboreum* var. *assamica* Watt. Type 10.

Plant tall. Leaf factor greater than 3; lobes 5-7; stem and leaves of a deep red or purple colour; bracteoles entire or with few apical teeth. Corolla with deep red "eye"; petals white, tinged with pink along margin and the portions exposed in the bud.

G. sanguineum Hassk. var. *minor* Gammie Type 11.

Plant small, with monopodial secondary branches few or none. Leaf factor less than 2; lobes 3-5. Flower yellow. Boll large. Includes types from China.

Corolla yellow-eyed; seed with fuzz Type 12.

" " " " naked Type 13.

" without eye; seed naked Type 14.

Plant differing from Type 2 in the character of the secondary branches. This group includes a complex series of forms from Persia. The simplest form is the true *G. herbaceum*, Todaro.

G. hirsutum Linn. This plant, which yields the bulk of the American cotton crop, has formed the basis of numerous experiments in India.

G. Stocksii Max. Mast. A wild form of *Gossypium* found on the limestone hills around Karachi.

Pollination. — The cotton flower is hermaphrodite and self-fertilisation is effective in almost every case. Experiments in cross-fertilisation show that the different forms of *Gossypium* fall into two marked groups, the members of which are fertile *inter se* but completely sterile between the two groups. These groups are characteristic of the Old and the New World and are respectively characterised by united and free bracts.

The colour of the corolla. — The colour of the petals may be yellow, white or red. The latter colour is only found in Types 3 and 11 and extends to the sap. Two forms of yellow are readily distinguished, viz. 'yellow' and 'pale-yellow'.

Breeding experiments show that yellow is dominant both to pale-yellow and to white. The inheritance of the pale-yellow factor is under further investigation.

The 'eye' of the petal. — All true Indian cottons possess an eye situated at the base of the petal. In some Chinese forms the petal is self-coloured

yellow, and crosses between these forms appear to show that the 'eye'-factor is dominant, though in one case an intermediate form of eye appeared and has bred true to this condition. This constitutes; therefore, a further type.

The red colouring matter in the sap. — The presence of red colouring matter in the sap entirely masks the true petal colour. The true petal colour can only be directly determined in cases of diseased flowers or such as open out of season. The factor for red-coloured sap appears to be dominant over its absence, though the intensity of the colour is diminished and the petals attain a condition known as 'red on yellow' when the cross is made with a yellow-flowered plant.

The type of branching and the length of the vegetative period. — The axil of the leaf of the cotton plant contains two buds, one main bud to which the second is accessory. Vegetative growth is effected by the development of a monopodium from either of these buds, reproductive growth only by the development of a sympodium from the former. Therefore according as the main bud develops into a sympodium or a monopodium, so will the appearance of the first flowers be accelerated or retarded; in other words the length of the vegetative period is controlled by the form of the secondary branches. In pure monopodial types even the ultimate secondary branches are monopodial. In sympodial types generally a few of the lowest secondary branches are monopodial. In hybrids between these forms every gradation is found and the change from the sympodial secondary branching to the lower monopodial branching is so abrupt that the character can be conveniently expressed as the percentage of the stem bearing monopodial branches. In actual practice, however, growth does not continue sufficiently long to enable this character to be determined accurately. The length of the vegetative period is therefore made use of in this connection. Determination of the correlation coefficient between the type of branching and the vegetative period gave 0.6628 and 0.8589 for different series.

Crosses between sympodial and monopodial types give F_1 generations with a vegetative period intermediate between those of the two parental types and approximating in a greater or less degree to that of the sympodial parent. The F_2 generation form a continuous series showing every degree of length of vegetative period, but, though the full sympodial type appears comparatively frequently, the full monopodial type only rarely or never does so. In the F_3 generation the average length of the vegetative period of a family approximates to that of the F_2 parents.

Conclusions. — Up to the present these studies have been confined to factors of considerable, though only indirect, importance. The more intricate task of studying the commercially valuable portion of the crop is the subject of further investigations.

- 627 - Oils in the Seeds of *Dumoria Heckeli* and *Baillonella toxisperma* Pierre. — DE WILDEMANN, E. in *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VI, No. 4, pp. 81-83. Antwerp, May 1914.

CROPS
YIELDING OILS,
DYES AND
TANNINS.

Dumoria Heckeli (1), found on the Ivory Coast by CHEVALIER is native of tropical virgin forests. Its seeds yield a semi-solid oil, snow white when fresh, with a pleasant sweet flavour and slightly aromatic, at the rate of 16.5 per cent. of the seeds or 33.25 per cent. of the kernels.

Baillonella toxisperma Pierre, or *Minusops Djawa* Engler, has been recently found in the Mayumbe district of the Belgian Congo. It yields a white aromatic oil at the rate of 56.04 per cent. of the kernels or 40.60 per cent. of the seeds.

Both residual cakes are unfortunately toxic on account of the presence of a glucoside of the saponin group, but they may be employed as manure, for they contain a considerable amount of potash and nitrogen (2 and 3 per cent. respectively) though very little phosphoric acid (*Dumoria Heckeli* 0.76 per cent.).

- 628 - The Improvement of Indigo in Bihar. — HOWARD, A. and HOWARD, G. I. C. in *Bihar Planters' Association Bulletin*. Calcutta, 1914.

The cultivation of Java Indigo (*Indigofera arrecta* Hochst.) in Bihar has rapidly declined since 1910, owing to the increasing prevalence of a so-called disease which prevents seed formation. The disease appears towards the end of the monsoon and is characterised by a great reduction of leaf surface and a change in the colour of the remaining leaves to a yellowish green slaty colour. Cultivation experiments have shown that this diseased condition of the plant is due to long continued wetness of the soil, which leads to the destruction of the young feeding roots, followed by leaf-fall and more or less complete wilting of the plant.

This wilting can be checked for a time if the plants are only pruned at the first cut, leaving one branch, instead of being completely cut back. The process is more conducive to normal growth and results in an increase in the total crop.

After the second cut in an ordinary monsoon the crop ceases to be profitable and should be dug up to make room for *rabi* crops.

The growth of indigo for leaf and for seed should be regarded as separate things and seed should not be raised from the old plants which have been cut for leaf. The best method of obtaining good seed of Java indigo is to sow the crop in lines about 24 inches apart in the middle of August on high-lying, well drained fields which are in good heart. After gathering the seed the crop can be grown on for leaf during the next monsoon. Being a thdeep rooting plant, the surface soil may be harrowed and the weeds a stroyed with great benefit to the plant. When wheat is grown as a oever crop an early maturing variety with little foliage and stout straw gives the best results.

Selection. — Owing to the frequency of cross-pollination the ordinary-

(1) See FOURNIER, J. *Etude pharmacologique des graines du Dumoria Heckeli et du Baillonella toxisperma* Pierre. Clermont Ferrand.

methods of single plant selection cannot be applied to this crop. Further, the method of estimating the indican-content is too difficult and expensive to be employed in selection experiments. Selection must therefore be confined to those individuals in the mixed crop which grow rapidly and strongly and which by their habit of growth and amount of leaf surface are likely to give the highest yields of leaf. A process of roguing will be necessary to remove all undesirable types and prevent their crossing with the better types. Similar methods require to be applied to the ordinary Bihar indigo (*I. sumatrana*), and a reliable system of seed distribution remains to be established.

RUBBER,
GUM AND RESIN
PLANTS

629. — **Hevea in Cochinchina.** — GIRARD, M. E. in *Bulletin Economique de l'Indochine*, Year XVII, No. 106, pp. 46-53. Hanoi, January-February 1914.

Effect of the dry season on Hevea plantations. — The dry season is in no way unfavourable to the growth of hevea in the deep soils of Cochinchina, more especially if the soil surface is kept stirred during the wet season so that the rainfall is absorbed. In one year in which the dry season extended over five or six months, the average circumference of trees increased 4 to 6 in. in certain groups, while individual increases amounted to as much as 7 in. The dry season is moreover eminently useful in checking the development of fungoid diseases, especially *Fomes semitostus*.

Contrary to results obtained elsewhere, the dry season apparently has a very favourable effect on the yield of latex. During November, December and January the highest yields are obtained, reaching in the latter month as much as 50 per cent. more than the average for the rainy season. When vegetation becomes active again the yield decreases rapidly and tapping is suspended.

Tapping lasts about 300 days, during 180 to 200 of which the yield is approximately equal to that obtained in the Malay States, whilst during the 100 to 120 days at the height of the dry season the yield is considerably higher.

Capacity of Annamite labour. — The skill and rate of working of the tappers gradually improved, so that the number of trees tapped per head rose from 125 to 400 per day. Further, each man, besides making three excisions on every tree, wetted the cuts, collected the latex and the scrap, carried the latex to the factory and cleaned all recipients employed. When the price of rubber went down, the process was simplified by suppressing the use of water on the cuts, with the result that each man was able to undertake 600 trees and each woman 450 trees per day; these figures represent averages for all the coolies over a period of several months and are important, as three-quarters of the expenses of production are represented by the cost of tapping. The writer considers that the suppression of watering will not only economise labour, but also prove beneficial by causing the latex to be less diluted and the rubber of better quality.

Advantages of smaller excisions. — After numerous experiments, the method of practising three excisions, 18 in. apart vertically, and only engaging one-fifth of the circumference of the tree, has been adopted, as the longer

rest gives the wound a better chance of healing, while the yield is increased or at any rate in no way decreased by limiting the tapping area.

630 - **Influence of the Partial Removal of the Bark on the Yield of Latex in *Manihot Glaziovii*** (1). — ZIMMERMANN, A. in *Der Pflanser*, Year X, No. 4, pp. 180-188. Daressalam, April 1914.

Experiments carried out at Amani and Victoria have shown that the partial or total removal of the bark of *Manihot Glaziovii* increases the production of latex. Of the two methods, the partial removal is more to be recommended, not only because it has a better effect on the yield of latex, but also because it requires less labour and is less liable to damage the tree.

631 - **The Industrial Uses of Maize when Cultivated for Sugar.** — BOYER, L. in *La Sucrerie Indigène et Coloniale*, Year 49, Nos. 10, 11, 13, 17, pp. 226, 252, 299, 343, 392. Paris, March 11 to April 29, 1914 (2).

SUGAR
CROPS

After a short account of the history of the subject, the influence of castration on the sugar content of maize juice is discussed. Of all known varieties the Giant Servian is the one which has the richest juice in sugars, but JUMELLE has also reported a variety from the Ivory Coast which yielded, with male castration alone, a juice containing 10.49 per cent. of saccharose and 1.23 per cent. of glucose, whilst the male castrated Servian variety only yielded 9.68 per cent. of saccharose and 1.32 per cent. of glucose.

The production of sugar from the juice has still to overcome certain practical difficulties. The ordinary process of extraction in use in sugar-beet factories only results in about half the saccharose being obtained in the form of crystallised sugar from a juice of 59 per cent. purity. The residual molasses contain a high percentage of glucose and are approximately of the same quality as molasses from refineries; they could be profitably used by working them up with the fibrous residues into stock food at the sugar factory itself, the food value of such a product being estimated on the basis of food values in straw. Or a still better use might be to reduce the stalks to a fine meal after a preliminary drying, and put the product on the market either in the pure condition or mixed with various other meals to increase its nitrogenous content and make it into a better balanced food. As the maize would be harvested during the warmest season of the year the stripped stalks could quite well be set up in sheaves to dry, so that their water content should be reduced to 15 to 20 per cent.

As raw material for the manufacture of denatured alcohol, maize is superior to beets both with regard to the produce obtained per ton of treated substance and to the possible profits. In comparing Giant Servian maize with beets of a corresponding sugar content, the value of the maize works out at 3s 9d per ton more than that of the beets; moreover the distillery residues of maize can be sold to paper works at 3s 6d per ton, while the beet pulp is only worth 2s 6d per ton.

(1) See ZIMMERMANN A., *Der Manihot-Kautschuk*, p. 176.

(Ed.).

(2) See No. 512, B. May 1913.

(Ed.).

- 632 - Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease (1) — BREMEKAMP, C. E. B. (Paseroean Experimental Station) in *Archief voor Suikerindustrie in Nederlandsch-Indië*, No. 14, pp. 514-519. Sourabaya, April 1914.

The vascular system of sugar cane plants suffering from sereh is stopped up with gummy matter which influences the circulation of water in the plant so that healthy stems absorb 1.18 times more water than affected stems. Using a lithium salt as an indicator, the writer showed that the salt had risen to a height of 70 cm. in 3 ½ hours in a healthy plant, while in a diseased plant it had only reached 30 cm.

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
CROPS

- 633 - Coffee in Tonking. — BOREL, M. in *Bulletin Economique de l'Indochine*, Year XVII, No. 106, pp. 54-60. Hanoi, January-February 1914.

The coffee bush is little pruned in Tonking owing to the borer (*Xylotrechus quadripes*), which causes so much damage on plantations that planters allow suckers to grow in order to furnish a substitute for the parent bush when the latter is attacked by the beetle. On the other hand the bushes are kept low by being topped as soon as they are one year old in order to develop the lower branches and expose the young plant less to the action of the wind. Usually the trunk is not allowed to grow above 5 ft. making with the uppermost branches a total height of 6 to 6 ½ ft., which could not be increased without letting some of the fruit get out of reach of the pickers.

Manurial requirements per bush are : 55 lbs. of dung every two years ; $\frac{3}{4}$ oz. of nitrogen, 1 oz. phosphoric acid and 2 ½ oz. of potash every year ; and every three years a dressing of lime varying in amount with the nature of the soil.

The yield per bush varies from ½ lb. to 2 lbs. of coffee, with an average of about 1 lb. Approximate estimates of expenses and returns on coffee plantations are as follows :

A. Plantation of 50 000 bushes.

	£
Total cost of establishing plantation spread over 4 years . .	4 310
Expenses during 5th year	1 188
Sales during 5th year :	
44 000 lbs. of coffee	1 804
live stock run on the plantation	225
	<hr/>
Total sales . . .	£ 2 029
Total profit.	841
less 15 per cent. to manager.	126
	<hr/>
net returns . . .	£ 715

or a return of 16.6 per cent. on a capital of £4 310 over and above a 5 per cent. interest on capital allowed for in estimated expenses.

(1) See No. 1541, B. May 1911.

[Ed.]

B. *Plantation of 160 000 bushes.*

	£
Total cost of establishing plantation spread over 4 years. . .	10 512
5th year:	
expenses. . . { estimated to counterbalance	3 267
receipts . . . { one another	3 310
6th year:	
expenses.	3 375
receipts	6 505
total profits	£ 3 130
less 15 per cent. to manager.	470
net returns	£ 2 660

or a return of 25.3 per cent. on a capital of £10 512 over and above a 5 per cent. interest on capital allowed for in estimated expenses.

634 - **Mocha Coffee Culture.** — RIES, M. and BARDEY, P. in *The Tea and Coffee Trade Journal*, Vol. XXVI, No. 1, pp. 19-26. New York, January 1914.

Mocha coffee derives its name from the small ruined town on the South Arabian coast of the Red Sea from which it used to be exported. It is an absolutely unique product with a flavour and aroma quite distinct from the Abyssinian variety, though many writers consider them identical.

The tree is cultivated in the province of Yemen, South-western Arabia, on terraced slopes, a southern aspect being preferred. The seeds, after being separated from the pulp, are rolled in ashes and preserved in a dry place. Seedlings are raised in nurseries on a fertile and well manured soil; they are protected from the sun, watered frequently and transplanted once or twice before being finally planted out 2 to 3 yds. apart. Plantations are all in the immediate neighbourhood of wells, as irrigation is absolutely necessary; the soil has to be kept loose and permeable by repeated cultivations. The crop is harvested continuously from August to March; the seed is hulled in a small stone mill, spread out to dry and packed in bags made of woven aloe fibre («sansevieria») and lined inside with the leaves of palm trees («doun»), this packing being known in the trade as the Mocha bag and constituting a kind of certificate of origin.

The trees belong to three main types: 1) pyramidal with the biggest branches at the base; 2) umbrella shape with the lower part of the trunk bare; 3) bush shaped.

In the low regions where rain is abundant, the fruit is larger but of inferior quality; in the hot dry uplands, growth is slower and the grain is smaller and rounder, but of the finest quality.

The annual production of Mocha coffee is about 100 000 bags of 160 lbs. each, and the principal importing countries are the United States which takes 30 per cent., France which takes 20 per cent. and Egypt which takes 18 per cent., others being the Red Sea ports (7 per cent.), Germany (5 per cent.), England (5 per cent.), Spain (3 per cent.), and Austria (3 per cent.). About half the amount is exported from Aden, and half from Hodeidah.

635 - **Vanilla in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture Tropicale*, Year XIV, No. 154, pp. 105-109. Paris, April 30, 1914.

Vanilla is successfully cultivated on various kinds of soil in Madagascar, not only on granitic alluvial soils, but also on the sandy soils of the coast and on basaltic or volcanic soils, though the two latter kinds are perhaps the most suitable. From a series of analyses carried out by the writer it would seem that a soil with a high phosphoric acid content is specially good, the best at Nossy-Bé containing a minimum of 0.4 per cent. and that of the most productive plantation containing 0.75 per cent.

The most usual shade and support tree is *Jatropha Cureas*, but *Dra-cæna tessellata* is also frequently used. Vanilla cuttings should always be at least 5 ft. long; they cost 2*d* to 2 ½*d* each. Decomposed banana stems are frequently used as manure in vanilla plantations.

The production of vanilla in Madagascar has been increasing of recent years. The figures for 1903-1912 are as follows:

	Amount tons	Value £
1903	11.5	8 264
1904	9.1	6 892
1905	30.4	18 619
1906	40.0	19 029
1907	50.0	39 875
1908	56.4	41 748
1909	42.6	47 639
1910	42.2	50 846
1911	51.7	40 986
1912	112.0	142 217

Further increases are anticipated, but over-production will be checked by the growing practice of planting other crops in vanilla districts.

Plant bugs are destructive to vanilla in Madagascar, especially *Memia viciinia* which punctures the pods and young buds, causing them to fall. Preventive measures have not yet been thoroughly investigated, but it would seem that the only means of checking the parasite would be treatment with hydrocyanic acid.

An average yield of vanilla in the green condition would amount to 530 lbs. per acre, while expenses of establishing the plantation are estimated as follows:

	per £	acre s
1st year - clearing ground, planting shade and support trees, planting vanilla cuttings, 3 hoeings	14	7
2nd year - 3 hoeings, cutting shade trees, replacing cuttings .	5	17
3rd year - as 2nd	5	17
4th year - as 2nd, pollination (22s) and harvest (14s) . . .	7	13
	£33	14

636 - **The Cultivation of Poppies for Opium and Seed in Various Countries.** —
Enquiry made by the International Institute of Agriculture.

The cultivation of poppies for opium in the Far East has been somewhat checked of recent years, but the crop remains an important one in many countries on account of the edible oil produced from its seeds. The replies to the circular letter on the subject sent by the Institute are abstracted below.

AUSTRALIA. — Victoria is the only State in the Commonwealth in which poppies are cultivated on a commercial scale, and even in that State, the area under the crop is very small, consisting of one or two acres during the years 1908-1912 with a total yield of 89 lbs. of opium in the whole period. The present price of opium is 30s a lb. and the product is used exclusively for pharmaceutical purposes.

CHINA. — According to the special convention of the Opium Agreement signed in 1911 between the English and Chinese Governments, the cultivation of the opium poppy in China and the importation of opium from India were to be proportionately and progressively reduced, starting from January 1st 1911, so that both local production and imports were to cease entirely by the end of 1913, and opium smoking to be prohibited after 1917.

EGYPT. — Poppies are cultivated in Upper Egypt chiefly for the sake of opium; oil is also extracted from the seeds and used for cooking.

Three varieties are cultivated, having respectively red, yellow and dark brown seeds, and all belong to the same species. In 1912-1913, 516 feddans (1) were under the crop, which is partly raised as a pure crop and partly in mixed cultures with other crops, such as wheat, barley, onions, fenugreek, *Carthamus oxyacantha*. Seed is sown in October, after the flood, at the rate of 1 kadah (2 $\frac{1}{4}$ quarts) per feddan and mixed with fine soil to facilitate the operation; no manure or irrigation water is applied. After a month the plants are singled 6 to 8 in. apart and 12 days later they are earthed up. When the plants are five months old, an incision is made in the capsules and the opium is collected the following day in the form of the solidified exudate, which is then kneaded into cakes and dried in the sun for four days. Each capsule is tapped three times.

A considerable amount of labour is required for the crop, making the cost of cultivation rather high:

	Cost per feddan, piastres (2)
Ploughing	50
Sowing	4
Singling	4
Earthing up	9
Making incisions	45
Collecting opium	120
Kneading "	9
Transport and storage	9
Hand threshing the seed with flails	10
Cleaning the seed	10

270 (£2 15s 7d)

(1) 1 feddan = 1.038 acre.

(2) 1 piastre = 2.46d.

The total production per feddan amounts to $1\frac{1}{2}$ ardebs (8 bushels) of seed, worth 112 piastres (£ 1 3s), 8 rotl (1) of opium, worth 960 piastres (£ 9 17s) and 120 rotl of oil. The stalks are sold for fuel and fetch 5s per feddan. An ardeb of seed yields about 80 rotl of oil, and the opium contains an average of 8 to 12 per cent. of morphine. Prices are very stable.

The only parasite dangerous to poppies is *Agrotis ypsilon*, which is kept in check by hand-picking the larvae.

No statistics exist on the consumption and exportation of opium, but imports for the years 1909-1912 were as follows :

	Amount lbs.	Value £ s d		
1909.	11 030	7	10	9
1910.	12 961	11	5	6
1911.	10 815	8	0	2
1912.	4 309	5	7	6

FRANCE. — Poppies are cultivated in various districts. more especially in the departments of Somme and Pas de Calais, but also in those of Ain, Aisne, Aube, Cher, Doubs, Maine-et-Loire, Nièvre, Nord, Seine-et-Marne, Deux Sèvres, Vienne and Yonne. The crop is raised for the sake of the oil obtained from the seeds, which is used as an edible oil in the north and also for the manufacture of paints. The two varieties of *Papaver somniferum* known as Pavot Gris Ordinaire and Pavot Œillette Aveugle are grown. The area under this crop, which was between 12 000 and 15 000 acres in 1900, was reduced to between 6450 and 6650 acres in 1910 and 1911.

Poppies replace beets or flax in the rotation. The land is prepared by autumn and spring cultivations, and seed is sown at the beginning of April at the rate of 2 to 3 lbs. per acre. Farmyard manure is applied, or cake residues, with 4 to 5 cwt. of superphosphate per acre. After-cultivation consists in hoeing and singling to a distance of 8 in. apart. Eighteen to twenty-seven bushels of seed are obtained per acre, yielding 45 to 50 per cent. of oil. Mean annual values for the period 1902-1911 are as follows :

Total area under the crop	acres	10 295
Total production	tons	5 100
Production per acre	lbs.	1 108
Total value of crop	£	77 048
Value of 1 cwt. of seed	s	15

French publications dealing with the subject.

MOHAMÉD EFFENDY CHARKANY. — *Thèse sur l'opium, soutenue devant l'Ecole de Pharmacie de Paris.* Paris, H. Plou, 1896.

GASTINEL. — *Monographie des opium de la Haute-Egypte (Mémoires de l'Institut Egyptien, Vol. I).* Paris, 1862.

H. SALLÉ et Cie. — *L'opium, son histoire, sa culture, ses applications*. Paris, 1900.
Journal de Pharmacie et de Chimie.

Series	Vol.	Page	
3	13	105	Culture en Arménie.
"	23	99	Récolte en Bithynie.
4	1	415	Culture dans la Haute-Egypte.
"	7	137	" "
"	18	66	Culture en Chine.
"	19	158	Culture dans l'Inde.
5	6	481	Culture dans la Zambézie.
6	21	403	Culture aux Etats Unis.
"	25	542	Culture.

CHALLAMEL has also recently (1913) published a book on opium.

JAPAN. — Poppies are only cultivated on a very small scale for the sake of the flowers and seeds, which are used in perfumery.

BRITISH INDIA. — Poppies are cultivated in the United Provinces of Agra and Oudh, in certain States of Rajputana, and in Central India, but they are no longer grown in Bihar. Opium production both for home consumption and for export is the main object, but the seed production is also considerable, as shown by the following figures :

Exports of poppy seeds.

	Amount cwt.	Value £
1910	814 871	559 890
1911	770 741	545 871
1912	497 862	391 899

The alkaloids morphine and codeine are manufactured from the opium and are mostly disposed of on the London market.

Owing to the restriction in the export of opium to China the area devoted to poppies in India has decreased from 564 585 acres in 1906-1907 to 182 558 in 1912-1913 and to 156 250 in 1913-1914.

The white variety is commonly cultivated, and grown from October to March after maize or millet. Usually it is grown alone, but occasionally the preceding maize crop is left standing to attract the insects which would otherwise injure the poppies. Heavy black cotton soils are preferred, and fields are selected in the highly manured circles round the villages, which receive 150 to 200 maunds (1) of cattle dung per acre per annum; in Fatehpur the land is often manured by herding sheep and goats on it, the dung of which is supposed to be of peculiar value. The plants benefit greatly if they are irrigated with well-water impregnated with nitrates (Khari), and manured with earth impregnated with saltpetre (Nonamati) or well rotted cow dung; ashes are also extensively used as top dressings. A finely powdered tilth is absolutely essential and the land is ploughed as

(1) maund = 28 lb.

many times as the cultivator has leisure for. Seed is sown from the middle of October to the end of December at the rate of about 3 lbs. per acre, having been previously mixed with earth. The ground is almost always prepared for sowing by a watering and in the drier portions of the United Provinces the plants are irrigated once a fortnight or three weeks between germination and harvest time, while in the Benares division four or five waterings are usually sufficient. The field is kept scrupulously clean, being weeded and thinned at frequent intervals.

The crop is ripe in February or March and the opium is extracted by means of incisions made in the pods in the afternoon, the exuded juice been collected the next morning. Each pod is lanced three or four times at intervals of two to four days. Linseed oil is freely used to remove opium that has hardened on the pod and as a medium in which to store the opium to prevent its drying out.

The process of manufacture is not ordinarily undertaken by the cultivator, but is in the hands of firms by whom the produce is bought and by whom the cultivator is often partly financed. The process is a very simple one: the opium is kneaded into balls and stored in racks covered with the dry leaves and stalks of the poppy plant. As it dries, the balls are apt to lose their shape and are periodically examined and reshaped, considerable importance being attached to the balls being spherical in shape and free from cracks, especially by the Chinese connoisseur.

Cultivation expenses amount to roughly 40 rupees (£ 3 6s 8d) per acre.

The specific diseases to which the poppy is subject in India are: *a*) root canker; *b*) sun burning; *c*) sclerosis, the symptoms of which are a gradual drying and hardening of all the plant tissues; *d*) *patechia*, in which the cuticle of the leaves becomes more or less densely covered with specks or spots somewhat resembling those caused by the bite of insects; and *e*) gangrene, which mostly affects the soft, herbaceous parts of the plant. Injuries are also caused by broomrape, various fungi, insects and birds.

The output of opium during 1912-1913 was approximately 19 854 cwt., excluding that grown in the Native States for which no reliable details can be given. The average content of morphia in opium ranges from 6 to 10.26 per cent. The whole of the opium produced is sold to Government by the cultivators at a fixed price and is then manufactured for export and for internal consumption. The quantity intended for export is put up to public auction in Calcutta every month in chests containing 140 lbs. each.

Imports and exports of opium during the period 1908-1912 are given below; imports consist mostly of Persian and Turkish opium required for pharmaceutical purposes; exports go to China and other countries.

	Imports lbs.	Exports cwt.
1908.	213	88 210
1909.	260	81 329
1910.	431	68 392
1911.	422	62 575
1912.	554	42 787

During 1913 the quantity to be exported was fixed at 32 125 cwt., the systematic reduction being due to the policy of restricting exports to China. The estimated annual consumption of opium in British India is 10 982 cwt.

For further reference see :

Watt's Dictionary of the Economic Products of India, Vol. VI, Part I. London, W. H. Allen and Co.

NETHERLANDS. — Poppies are cultivated in districts possessing a heavy soil, more especially in the provinces of Groningen, North Holland, South Holland and Zealand. A variety of *Papaver somniferum* L. with blue flowers, indehiscent capsules and grey or grey-blue seeds is in common use, and the plant is cultivated for the sake of its seeds from which oil is extracted. The average area under this crop during the period 1901-1911 was 808 acres, but increased to 1623 acres in 1912 owing to the rise in price of the seeds.

Poppies follow red clover, oats or barley in the rotation: cultivation consists in ploughing deeply and applying dung or superphosphate according as the preceding crop was a cereal or a leguminous crop. Seed is sown in April or May in drills 24 to 26 in. apart and the plants are singled to a distance of 3 to 5 in. apart in the rows. The crop is kept hoed and ripens in August, being harvested in a very dry condition so that the capsules may be threshed immediately; if threshing has to be delayed the plants are tied in bundles and placed in small heaps.

The average production per acre amounts to 18 to 22 bushels of seed, yielding 50 to 60 per cent. of oil, and 12 to 16 cwt. of straw. Poppy cake makes a useful cattle food, but the poppy straw is of very little value.

Prices for poppy seed ranged very high in 1910, causing an increase in the area under the crop in 1912. As a result, before the harvest the seed fetched £1 9s 4d a cwt., but after it fell to about £1.

Poppies are a hardy crop and have few enemies in the Netherlands.

There exists no special publication on the cultivation of poppies in the Netherlands, but a chapter is devoted to the subject in *Byzondere Plantenteelt*, J. Z. TEN RODENGATE MARISSEN. Groningen, J. B. Wolters.

PERSIA. — Poppies are cultivated in all the provinces except Kazvine, Zindjan, Guilan, Mazenderan, Astrabad and parts of Azerbaydjan. The white flowered variety is commonest and the red and purple flowered varieties are also grown, the production of opium being the chief object. The harvest is very early, especially in the south, so that the crop is usually followed by melons, sesame, lentils, beets, millet, etc., and then the land is again put to poppies, or the poppy crop may be followed by two years' fallow. Cultivations consist of a single ploughing (or spading in the South) and dung or nightsoil is used as manure. Seed is broadcasted at the rate of 1.4 to 1.8 quarts per acre. The crop is hoed for the first time as soon as the seedlings have four leaves and they are then singled to a distance of 6 to 8 in. apart; a second singling takes place after 20 to 30 days, further thinning out the plants to 10 to 12 in. apart. Irrigation is applied as required with a maximum of three waterings.

Opium collecting from incisions begins when the two lowest leaves have turned yellow, when the three upper leaves begin to lose their colour and the operculum of the capsule blackens. Incisions are made at midday and the exudate is collected at sunrise the next morning. A second incision is made a few days later, but the yield in this case is much smaller.

Expenses for raising the crop amount to about £5 per acre, average returns being 200 lbs. of seed and 32 lbs. of opium per acre, fetching 13s 4d per cwt. and 14s 4d to £1 5s 2d per lb. respectively. Imports and exports of opium are as follows:

		Amount lbs.	Value £
Imports . . .	1908	997	354
	1909	543	174
	1910	610	232
	1911	7 915	7 636
	1912	2 421	2 834
Exports . . .	1908	580 737	250 112
	1909	663 345	306 034
	1910	494 434	229 042
	1911	528 959	391 317
	1912	719 162	607 238

The home consumption is considerable, though its actual amount is unknown.

SERVIA. — Poppies are cultivated on a large scale only in those parts annexed during the late war, and no data on the subject are at present available.

637 — *Cymbopogon coloratus* Oil from Fiji. — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 48-51. London, January-March 1914.

Recent investigations have been carried out at the Imperial Institute on the composition of the essential oil of *Cymbopogon coloratus*. The principal constituents are citral (40 per cent.) and geraniol (23 per cent. in the free state and 10 per cent. in the form of geranyl acetate); the oil is therefore intermediate in composition between citronella and lemon-grass oils and was assigned a value intermediate between those of the two above products by commercial experts.

FRUIT GROWING

638 — Winter Spraying of Fruit Trees with Nitrate of Soda. — BALLARD, W. S. and VOLCK, W. H. in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 437-444, + 2 plates. Washington, D. C., February 1914.

These experiments on the effect of winter spraying with various solutions on the time of blooming and yield of fruit were begun in February 1912 and continued during 1913. The orchards used consisted of the Yellow Bellflower variety of apples, which bloom abundantly but only set a poor crop of fruit.

Seven 12-year-old trees were sprayed on February 2, 1912, with a solution of: nitrate of soda 50 lbs., caustic potash 7 lbs. and water 50 gallons, at the rate of 7 gallons per tree. Adjoining this row was a check row

of seven trees which received no winter spraying and a selected vigorous tree which received 50 lbs. of nitrate of soda ploughed in and washed down by the rains. In April it was found that the nitrate spraying had advanced the blossoming period about two weeks ahead of the normal period. The foliage buds were not so much affected, their condition remaining similar to that of the check row. Later in the spring the effect on the foliage growth became more pronounced and the sprayed trees assumed a more vigorous green appearance than the check trees. The single tree that received 50 lbs. of nitrate of soda applied to the soil showed no greater vigour than the check trees. During the summer both rows received sprayings for the control of apple powdery mildew and codling moth, and the crop loss from these and other insect pests did not exceed 1 per cent. on either plot.

In the autumn, the check row of trees yielded 8 loose boxes of fruit, while the nitrate-sprayed row produced a little over 40 boxes. The single tree which received 50 lbs. of nitrate as fertiliser showed no increased production. In the spring of 1913 this row of nitrate-sprayed trees showed large plump fruit buds and blossomed several days ahead of the control row, showing that the effect of the winter spraying continued to some extent in the second year.

Similar experiments were carried out in 1913, using different solutions; it was found that:

1. A solution of nitrate of soda (1 lb. per gallon) stimulates the trees to blossom earlier, and the effect is increased by the addition of either caustic soda or caustic potash.

2. The effect is proportional to the strength of the solution within certain limits. The best results were obtained with a solution of the following strength:

Nitrate of soda	200 lbs.
Caustic soda	20 lbs.
Water	200 gallons

3. Oxalic acid at the rate of 50 lbs. per 125 gallons of solution can replace the caustic soda with equally good results.

4. Nitrate of lime (130 lbs. per 100 gallons) and calcium cyanamide (92 lbs. in 100 gallons) also caused the trees to bloom earlier.

5. Sulphate of ammonia is considerably less effective than nitrate of soda.

6. Sodium chloride produced a distinct effect, sulphate of potash a slight effect and double superphosphate none at all.

7. The results with stone fruits were not so striking as those with apples and pears, but it is possible that stronger solutions together with earlier and repeated spraying may bring about better results.

Rain immediately following the application will wash much of the material off the trees, and it appears that at least a week of clear weather should follow the spraying, in order to ensure good results. The greater

danger of injury from frost that might result from forcing trees into bloom earlier than normally would have to be taken into consideration in making practical use of nitrate spraying in winter.

- 639 - **The Effect of Dust from Cement Mills on the Setting of Fruits.** — ANDERSON, P. T. in *The Plant World*, Vol. 17, No. 3, pp. 57-68. Tucson, Arizona, March 1914.

The decrease in the productivity of fruit trees in the vicinity of cement mills is attributed to the solution of the dust in the stigmatic secretions, which prevents the germination of the pollen. The dust contains a large amount of alkaline soluble lime, and artificial tests show that pollen will not germinate even in a very weak solution of the dust.

- 640 - **Shallow Cultivations in Vineyards.** — COUDERC, in *Comptes-Rendus de l'Assemblée Générale de 1914 de la Société des Agriculteurs de France*, No. 3, pp. 525-526. Paris, May 19, 1914.

In order to avoid chlorosis in shallow soils overlying chalky subsoils, very shallow cultivations, less than 1 in. deep, were adopted and gave good results. Not only were the vines less affected with chlorosis, but they also suffered less from drought. A light spring-time cultivator was used for the purpose, and cultivations had to be carried out before the weeds got any hold on the land in order to keep it clean. Such shallow tillage cannot be practised indefinitely, as after a certain number of years the soil must again be stirred to a greater depth and well manured in order to stimulate the growth and development of the roots, which would otherwise succumb to the attacks of phylloxera.

- 641 - **Influence of American Vine Stocks on the Quality of the Wine Produced in Champagne, France.** — MANCEAU, F. in *La Vie Agricole et Rurale*, Year III, No. 22, pp. 621-624. Paris, May 2, 1914.

The wine produced from grafted vines has been compared with that from ungrafted vines each year since 1897. A number of research stations exist for the purpose in Champagne and growers send in numerous samples to be examined, so that a large amount of data is accumulating and it will shortly be possible to publish a list of American vine stocks classified according to their influence on the resulting wine.

The quality of samples is determined partly by tasting and partly by chemical analysis. Testing is carried out at various times of year, in the January or February following the vintage, and again in subsequent years during the second fermentation in bottles for champagnisation; thus reliable results are obtained by following out the process of maturation in the wines. The investigations have shown that only a few stocks exercise an unfavourable influence on the wine; the majority when grafted with Meunier, Pinot noir and Chardonnay blanc, yield wines up to the general standard of the district; specially good stocks recommended by the writer are the following:

Chasselas X Berlandieri 41 B for calcareous soils.

Berlandieri X Riparia 420 A, 34 E.M. and 157-11.

Riparia X Rupestris 3309 and 101-14.

The stocks influence the ripening period: for instance Pinot noir on Riparia Gloire of Montpellier ripens 8 to 10 days sooner than on its own roots; on Chasselas Berlandieri 41 B it is 5 to 6 days earlier; Mourvèdre \times Rupestris 1202 on the other hand retards its ripening 8 to 10 days, while Riparia \times Rupestris 5306 and 3309 also have a slight retarding influence.

642 — **The Papaya in Hawaii** (1). — HIGGINS, J. E. and HOLT, V. S. in *Hawaii Agricultural Experiment Station, Bulletin*, No. 32, pp. 44. Washington, March 26, 1914.

The papaya (*Carica papaya*) flourishes in all drained and aerated soils in Hawaii. Though irrigation will increase the crop, an abundant water supply is not essential and papaya will give good results on a soil just too dry for oranges. Suckers should be removed at first, but after the plant has fruited two or three times, the main stem should be cut down and replaced by one of the suckers left for the purpose. The whole plantation should be renewed after about four years' bearing.

The fruit will travel well if certain precautions be taken, *i. e.* the fruits, preferably those belonging to the long-fruited varieties, should be picked at the first sign of ripeness, wrapped in paper and packed in straw board

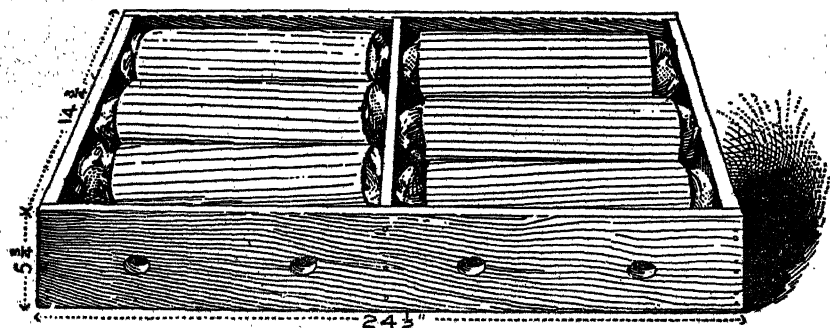


Fig. 1. — Crate for transport of papayas (open).

in well ventilated crates (the size of the latter is indicated in the accompanying figs. in inches).

Seed kept for propagation is washed and dried and preserved in glass bottles; it is sown in a well drained soil and germination takes place in from two to six weeks according to the temperature; when one month old the seedlings are transferred to a nursery, and at two months old are planted out about 10 feet apart. Experiments on vegetative propagation carried out at the Experiment Station have given promising results, making it probable that the fruiting season will eventually be made several months earlier. In breeding papayas, the following points should be borne in mind:

(1) See No. 813 B. July 1913.

(Ed.).

1. Trees bearing their fruit high (more than 6 ft. from the soil level) are preferable to those bearing their fruits close to the soil.

2. Numerous lateral branches requiring frequent pruning are a disadvantage.

3. Hermaphrodite or elongata varieties are better than round dioecious varieties, as males represent 75 to 85 per cent. of the latter and cannot be distinguished before flowering.

4. The most desirable size of the fruit depends on the use to which it is to be put. Table fruit should not be too large, while fruits for the production of papain should, other things being equal, be as large as possible ;

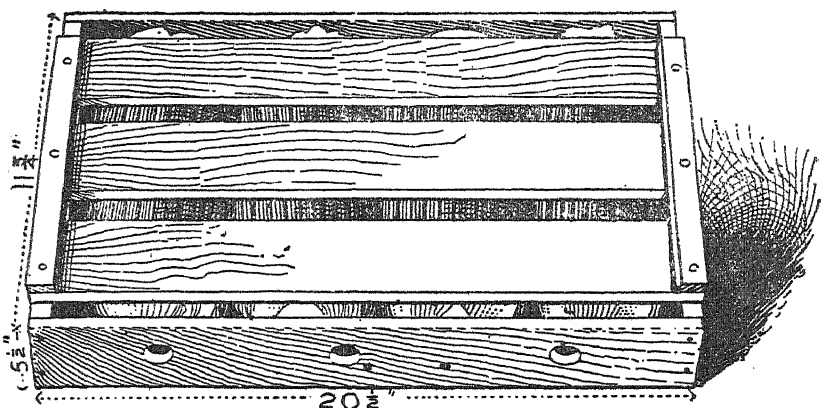


Fig. 2. — Crate for transport of papayas (closed).

and for this latter purpose too, fruit with a high papain content should be selected.

5. The long and round varieties should be kept separate and bred as constant and distinct types.

6. At present there is a tendency to unequal ripening of the opposite ends of the fruit which should be corrected. The ripe fruit should be of a fine yellow gold colour ; the flesh should be firm and of a yellow, red or pink colour, easily detached from the seeds and placenta and possessing a good flavour.

The papaya tree is subject to attacks from *Tetranychus* sp. on the lower surface of the leaves and on the fruits, and from the larva of the fly *Cryptoblabes aliena*, neither of which are serious enemies.

The harvest and preparation of papain are described in this bulletin.

643 - **Propagation of the Seedless Breadfruit.** — WESTER, P. J. in *The Philippine Agricultural Review*, Vol. VII, No. 3, pp. 97-99. Manila, March 1914.

The seedless breadfruit is one of the best and most nutritious fruits in the Philippines, but it is also one of the rarest owing chiefly to the difficulty of propagating it. The ability of the roots to sprout under certain conditions led to a series of experiments being carried out in 1913 at the

Lamas Experiment Station with the object of finding a simple and practical method of propagation. The following method gave good results: Root cuttings 20 to 25 cm. (8 to 10 in.) long and 1.5 to 6 cm. ($\frac{1}{2}$ to 2 $\frac{1}{2}$ in.) thick are struck in a bed consisting of a layer of clean sand 18 cm. (7 $\frac{1}{2}$ in.) thick situated in a sheltered and well drained position. The cuttings are inclined at an angle of 45° and buried three-quarters of their length, being set 20 to 30 cm. (8 to 12 in.) apart in rows 30 to 50 cm. (12 to 20 in.) apart. If planted in the rainy season, the cuttings require no further care; if not they must be watered. When 20 to 25 cm. (8 to 10 in.) high the cuttings are transplanted to a rich shaded soil, and when the plants are 60 cm. (24 in.) high they are ready for transplantation to the orchard. The roots should be disturbed as little as possible during the operation and a large ball of earth be moved with the plant. In replanting it is important not so set the plant deeper in the soil than it was in the nursery and a plentiful use of water should be made both before and after the operation.

LIVE STOCK AND BREEDING.

644 - **Results of Preventive Inoculation against Foot-and-Mouth Disease in Hungary, 1913.** — MEZAY, BÉLA in *Allatorvosi Lapok*, 1914, p. 238.

HYGIENE

From observations made by the writer during the last campaign against foot-and-mouth disease in Hungary, it appears that, after undergoing preventive inoculation against this disease (aphtisation), a large number of animals became seriously ill. In many cases recourse had to be had to operations, while in others further complications caused by other diseases were set up, and some cases resulted in death.

In one district, the disease reappeared two or three months after the inoculation in a form more dangerous than the first.

645 - **Utilization of Potato and Jerusalem Artichoke Haulms.** — VÖLTZ, WILHELM; BAUDREXEL, AUGUST; and DEUTSCHLAND, ARNOLD in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 105-160. Berlin, March 11, 1914.

FEEDS
AND FEEDING

The writers carried out at the Berlin Agricultural College exhaustive experiments on the utilization of dried and ensilaged potato haulms and dried leaves and stalks of Jerusalem artichokes. The animals used for the experiments were three sheep and four milch-cows; they were fed good meadow hay besides the experimental fodder. The haulm was from Silesia potatoes, and was dried in a hot-air apparatus; some was fresh when cut, while some had been frosted. For the utilization trials, two sheep were fed each $\frac{3}{4}$ lb. of hay with 1 lb. of haulm, the fresh haulm period preceding the frosted haulm one.

From these trials, as well as from a previous one (1) made with haulm from Wohltmann potatoes dried on the field, it appears that the percentage digestibility of dried potato haulm is about as follows:

(1) Cf. W. VÖLTZ and A. BAUDREXEL: Ueber die Verwertung des Kartoffelkrautes und der Kartoffelbeeren durch Wiederkäuer. *Landw. Jahrbücher*, Vol. 43, pp. 177-210. Berlin, 1912.

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
64	57	53	66	68	63

There was very little difference between the three types, and none of them upset the health of the animals.

The amount of digestible nutritive matter contained in dried potato haulm appears from these experiments to be about the same as that of good meadow hay; this is confirmed by a later experiment on four milch-cows, carried out with the object of ascertaining the effect of potato haulm on the quantity of milk and milk-fat and the total dry matter in the milk.

Ensilaged potato haulm was also prepared from the green haulm kept two months in a silo under strong pressure; after this, part was dried and the other part preserved in tin boxes. The loss of crude nutritive matter in the silo was 33 per cent. on the organic matter and 25 per cent. on the crude protein, while the digestible nutritive matter lost 35 per cent. on the organic matter and 13 per cent. on the crude protein. The first utilization trial was made with the moist ensilage; two sheep were fed daily 4.4 lbs. ensilage with 0.77 lb. hay and 3.72 lbs. ensilage with 0.65 lb. hay respectively. Then followed an experiment with dried ensilage, during which one sheep was fed daily 0.78 lb. ensilage and 0.62 lb. hay.

Of the nutritive matter contained in the ensilaged potato haulm the following percentages were digested:

	Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
Fresh ensilage	62	62	66	60	63	58
Dried ensilage	65	56	77	65	67	66

The leaves and stalks of Jerusalem artichokes were dried by hot air and 1 lb. of them fed daily with $\frac{3}{4}$ lb. of hay to two sheep. As percentages of digestibility the following figures were found:

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calories
65	55	70	54	72	66

According to its content of crude nutritive matter and digestibility, the Jerusalem artichoke haulm is about equal in value to good meadow hay. When fed alone, however, it causes strong fermentation in the alimentary canal, so that not more than half the bulky food should be replaced by it.

646 - **Feeding Experiments with Rice Gluten Food.** — HANSEN, REISCH, E. and SCHWEIGER, M. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 21, pp. 245-248. Hanover, May 22, 1914.

Under the name of "Reiskleberfutter", a food for milch cows is sold in Germany; it consists of a mixture of rice gluten and rice meal. The first is a by-product of the rice starch factories and is rich in protein, while the latter is a residue of rice milling. The writers have conducted a feeding experiment with the mixture which has the following composition :

Dry matter	93.30	per cent.
Crude protein	36.94	» »
Pure protein	31.25	» »
Fat	11.86	» »
N-free extract	36.87	» »
Crude fibre	1.32	» »
Ash	5.31	» »

The amount of nutritive matter contained in the food is so high that it places the mixture on a level with oil cakes containing an average amount of protein. Its starch value is, according to the authors, about 71.77 per cent. and its protein content 22 per cent.

The food was fed with meadow hay, dry beet slices and brewer's grains mixed with molasses as basal ration, and compared with earthnut cake and wheat bran. The animals experimented upon were 18 Lowland cows in full milking. The quantity of rice gluten food was 6.6 lbs. during one period and 11 lbs. during the next. During the 75 days that the experiment lasted, record was kept of the daily milk yield, of its quality and of the changes in the live-weight of the animals.

The results of the experiment are that the rice gluten food under examination has the same value as a mixture of earthnut cake, dry beet slices and wheat bran; consequently the writer recommends it for the feeding of milch cattle when it can be bought at a suitable price.

647 - **Colt-breeding in Pennsylvania.** — COCHEL, W. A. and SEVERSON, B. O. *Pennsylvania State College, Agricultural Experiment Station, Bulletin* No. 122, 14 pp. Centre County, Pa., July 1913.

HORSES,
ASSES AND
MULES

The writers carried out, in the State of Pennsylvania, where all the farmers buy their draught horses, a breeding experiment with 10 weaned Belgian and Percheron colts, with a view to ascertaining whether it is profitable for the farmer to breed his own draught horses.

The colts were divided into two groups of 4 and 6, and were fed, during the 532 days covered by the experiment, in the manner shown in Table I.

TABLE I. — *Daily Ration of each Colt.*

1. *Winter Period* (168 days).

1st Half.	Group I.	5 lbs. mixed grain (1); 8.2 lbs. maize ensilage; 7.4 lbs. hay.
	Group II.	5 lbs. mixed grain (1); 10.6 lbs. hay.
2nd. Half	Group I.	7.5 lbs. mixed grain; 13.1 lbs. hay.
	Group II.	Same as Group I.

2. *Summer Period* (106 days).

Both Groups: For the first 28 days: 5.5 lbs. mixed grain; 10.6 lbs. hay.

Afterwards: pasture, with mixed grain as supplementary food.

3. *Winter Period* (168 days).

1st Half: Both Groups: 8.4 lbs. of a different mixture of grain (2); 16.6 lbs. hay.

2nd Half: Both Groups: 10 lbs. mixture (2); 17.5 lbs. hay.

Notes. Mixture (1) was composed of: 5 parts maize.

3 parts oats.

2 parts wheat bran.

1 part linseed meal.

Mixture (2) was composed of: 6 parts maize.

2 parts oats.

1 part wheat bran.

1 part linseed meal.

The animals, which were then two years old, were broken to work after the third period of the experiment.

The experiment was carried out without mishap and gave the results shown in Table II.

TABLE II. — *Results of the Experiment.*

Average weight per colt at the beginning.	589.87 lbs.
" " " " after the 1st. Period	834.14 lbs.
" " " " " 2nd. "	1097.71 lbs.
" " " " " 3rd. "	1318.96 lbs.
Average increase in live weight per colt in the 1st. Period	244.27 lbs.
" " " " " 2nd. "	263.57 lbs.
" " " " " 3rd. "	219.25 lbs.
Average daily increase in live weight per colt in the 1st. Period . .	1.45 lbs.
" " " " " 2nd. "	1.34 lbs.
" " " " " 3rd. "	1.30 lbs.
Total increase in live weight per colt.	727.09 lbs.
Average daily increase in live weight per colt.	1.36 lbs.
Total cost of food and labour.	\$ 980.893
Total cost of the ten colts by the end of the experiment	\$ 1893.390
Value of the ten colts	\$ 2.350
Profit on the ten colts	\$ 456.610
Profit per colt	\$ 45.661

CATTLE

648 — **Crossing Bison and Cattle.** — 1. BOYD, MOSSOM M. (Bobcaygeon, Ont., Canada) in *The Journal of Heredity*, Vol. V, No. 5, pp. 191-197. — 2. GOODNIGHT, CHARLES (Goodnight, Texas) *Ibid.*, pp. 197-199. Washington, May 1914.

I. — Mr. Mossom M. Boyd publishes the first results obtained from his four years' experiments in the crossing of bison with domestic cattle.

He obtained about 30 hybrids. As to colour, the offspring of Hereford dams had white faces, but apart from these, the animals were practically whole-coloured, and were either brindled or a rich brown-black. The brindled varied between a tawny red and brown. The hybrids were, as a rule, larger and better proportioned than the bison; they stood more upright, had a less shaggy coat, and were altogether of better appearance.

The $\frac{3}{4}$ bisons, the product of a bison bull and hybrid females, did not differ one from another more widely than do different specimens of hornless Aberdeen-Angus. Their characteristics were midway between those of their parents. The $\frac{1}{4}$ bisons (Aberdeen-Angus or Hereford sire, hybrid dam) all exhibited the same build, but varied in colour. They resembled one parent as much as the other. The same is true in the case of the $\frac{1}{8}$ bison, obtained by a second cross with a pure domestic bovine animal. To the ordinary observer, the $\frac{3}{4}$ bison is easily confused with the bison, while the fine texture of the coat will alone serve to distinguish the $\frac{1}{4}$ bison from pure-bred domestic cattle. Taken altogether, the type of each class was homogeneous, and the proportion of bison blood regulated the likeness to that animal. As was expected, the proportion of bison blood did not regulate the appearance of the cattaloes (offspring of two crossbred animals). A number of these animals exhibited a greater similarity to the bison than did the hybrids.

On the whole, the results obtained are encouraging. Two especially interesting points immediately emerge, namely:

1. Crossing with bison is capable of improving the coat of the animals. Cattaloes with even less than $\frac{1}{10}$ bison blood may, with proper selection, have as good a coat as $\frac{1}{2}$ or $\frac{3}{4}$ bisons.

2. There is hope of being able to effect a great improvement in the capacity for beef-production. The bison's hump does not, as most people imagine, consist of a lump of fat, but of masses of muscle attached to neural spines double the length of those of domestic cattle. If it is borne in mind that the beef from the backs of cattle is the most valuable, it will be easily understood that the development of this characteristic is of first-rate importance. The writer obtained hybrids with humps 9 inches thick.

It is noteworthy that the experiments of the first class are not unattended with some danger. In this case, the principal effect of the first crosses was, in every cow without exception, an abnormal secretion of the amniotic fluid, which proved fatal in a large proportion of cases. Fortunately, considering that nothing of this kind had been in the least expected, the experiment had been made on a very large scale.

It should be observed that the writer was unable to raise a single fertile male hybrid. Of six born, only two survived the first 24 hours, and of these one was killed at an early age, without having been tested, and the other was barren. This agrees with the experiments made by Col. Ch. Goodnight, who states that he was unable to raise hybrid bulls. Ten male $\frac{1}{4}$ bisons were obtained, of which four were tried; only one proved fertile. Of five $\frac{3}{4}$ bisons only one was a bull, and he died as the result of an accident. The only $\frac{1}{8}$ bison tried proved fertile. In 1905 a $\frac{5}{8}$ bison was successfully reared, the offspring of a cross between a bison and a $\frac{1}{4}$ bison cow. This cross was interesting from the fact that difficulties of the same kind as those mentioned above in connection with the first cross were met with. This bull sired one calf in 1911 and four in 1912.

He is of a more elegant build than the true bison, and has a very well-developed back.

The results given by the crossbred cows are as follows: of 24 hybrids, 15 were barren, and only three were regular breeders. Up to 18 years of age they had respectively 9, 10 and 12 calves. Of the twelve $\frac{1}{4}$ bison cows only one was barren. Of four $\frac{3}{4}$ bison cows only one proved barren, but it must be admitted that the bull was not a good breeder. Of five $\frac{1}{8}$ bison cows, one was spayed at 5 $\frac{1}{2}$ years, without having had a calf up to that time. The other four were fertile.

The writer has not yet been able to obtain any results from the cattaloos, the experiments with which are still going on at the present time.

2. — Col. Goodnight has carried out crossing experiments in Texas between bison and domestic cattle. By putting domestic cows to a bison bull, he has only been able to rear successfully one bull-calf. The $\frac{3}{4}$ bison bulls proved barren, though the cows were perfectly good breeders.

Cattaloos shew a certain number of advantages over domestic cattle. They have a much higher disease-resisting power, especially as regards "Texas Black Leg" and Texas fever. Secondly, their weight is higher, as well as their beef yield (fully 70 per cent.). The beef is of good quality and never becomes leathery as it does in the bullock. The great development of the dorsal region enables them to produce about 150 lbs. more than any domestic animal. They are not subject to cattle panic and do not flee before storms, but face them as bison do. They can stand privation of water much longer than other animals; they are docile and never fight, and can do well under conditions which would be fatal to other animals.

649 — **Observations on the Origin and Distribution of Breeds of Cattle in French West Africa.** — JACOB DE CORDEMOY, H. in *L'Agriculture Pratique des Pays Chauds* Year 14, No. 130, pp. 24-36. Paris, January 1914.

The cattle of French West Africa may be traced to two definite types: 1) the zebu, or humped ox; 2) the humpless (taurine) type.

These two types have different areas of distribution, but at the borders of the two areas occur numerous races of a mixed or abnormal character, making the distinction more difficult. What is the primary origin of these types? The zebu is certainly an imported type, of Hindu origin, and its line of advance can easily be traced from the East to the West coast of Africa. The origin of the taurine type is a more disputable matter. Many writers admit the Asiatic origin of the taurine stock in Guinea, but Pécaud, who has long made a study of the cattle of Dahomey, thinks that the taurine type is indigenous to Central and West Africa.

The writer does not share this opinion, for two reasons: 1) many Central and West African tribes were cannibals, a practice not observed where meat is obtainable, as is the case when cattle are raised; 2) it is difficult to reconcile the existence of indigenous breeds of cattle with the fact that no aboriginal race practises stock raising; the only tribes which practise it are the Peuhlish peoples and the descendants of Peuhlish mixed marriages, and the Peuhls are foreign immigrants.

The zebu type may always be recognized by the hump, more or less highly developed, above the withers.

The other type is the Asiatic taurine type, which may be recognized by its height and more especially by the horns, which are strongly developed and lyre-shaped, a characteristic which persists in all breeds derived from this stock. A further confirmation of the Asiatic origin lies in the fact that these two types of cattle are found in all the countries right across the continent.

Dr. Decorse has described a third type, which he calls the Lake Tchad breed, but from the description he gives of it it appears to be merely an Asiatic breed. The writers opinion it shared by the Belgian veterinary surgeon Willaert, who only recognizes the zebu and taurine types.

The zebus were introduced by the Peuhlish invasion; they advanced westward along the 14th parallel, and from there some must have gone up and some down the Niger, but they followed rather a north-westerly route, on account of the trypanosomiasis in the south. Nowadays, the distribution of the zebu is limited to the south by the 13th parallel, and to the north by Upper Guinea. The two chief centres of the breed are, on the one hand, Senegal, and on the other, the countries round the mouth of the Niger.

The taurine type, also introduced by the Peuhls, seems to have been given up by them at a fairly early period to the natives of Upper Dahomey. It now forms the only bovine population in Dahomey and Guinea. There are three distinct breeds or varieties:

1. The Borgu breed, in Upper Dahomey.
2. The small Somba breed, found in the neighbourhood of Jugu Kwande and the Atacora Range.
3. The Wemé or Lagoon breed, in Lower Dahomey; this breed is of small stature and appears to be degenerating in consequence of unfavourable conditions of soil and climate.

Variations due to climate are very noticeable in Guinea. The characteristic breed of Guinea is the N' Dama, which has produced two varieties, one small (43 in. high) and another taller (55 in.), which Ghebbard and the writer believe to be two modifications, produced by the climate, of one and the same breed.

650 - **Connection between Growth of Bone, Horn Development and Performance in Cattle.** — MÜLLER, MAX and NARABE, K. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 1-40. Berlin, March 11, 1914.

After a short summary of Laurer's studies on the connection between growth of bone and horn development in Kehlheim (1), Simmental, and Lowland cows, the writers discuss the results of similar work on 59 Dutch, 59 Ayrshire and 18 Simmental cows. These investigations were carried out in Japan on pedigree animals, partly imported and partly bred at Hokkaido.

As in Laurer's investigations, the circumference of the cannon bone,

(1) A local brachycephalous draught breed, chiefly bred in the Upper Bavarian Palatinate.

and the length and circumference of the horns were taken as test measurements. Besides these, ten other measurements were taken with the object of throwing light on other points. After being measured, the animals were divided into groups and studied as to the connection between horn development and size of bones, between horn development and age, and between size of bones and age. The measurements of the Hokkaido-bred cows were compared with those of the imported ones. Besides the above, the relation between bone and horn development on the one hand and milk yield on the other was also studied in Ayrshire cows and at the same time the milk yields and live weights were compared with the horn and bone measurements.

The investigations led to the following conclusions :

1. In the breeds examined, increase in the size of the bones is correlated with decrease in the thickness and length of the horns, as Laurer had already found. This correlation seems to be more marked in Ayrshires than in Simmentals or Dutch cows.

2. The imported and Hokkaido-bred Ayrshire and Dutch cows did not show any appreciable difference in the circumference of the cannon-bone. The absolute circumference of the horns seems to diminish from generation to generation in Ayrshires and Dutch cows bred in Japan. The absolute horn length of the Ayrshire cows born in Japan is greater than in the original Ayrshires, while in the Dutch cows the opposite takes place. The different growth of the horns in the original breeds and in the animals raised in Japan is to be attributed only to the difference of environment.

3. The small-boned Ayrshire cows are in general, notwithstanding their relatively smaller live-weight, better milkers than the large-boned ones weighing about 110 lbs. more. Also the fine-horned Ayrshires under experiment proved better milkers than the thick-horned ones, while length of horn was not correlated with any difference in this respect.

It appears that well developed bone and slightly developed horns in young animals point to a continuation of growth of body, while moderately developed bones together with highly developed horns are signs that body growth will stop early.

651 - **Raising and Fattening Beef Calves in Alabama.** — GRAY, D. T. and WARD, W. F. — *Bulletin of the U. S. Department of Agriculture*, No. 73, 11 pp. Washington, March 30, 1914.

Experiments were carried out to determine the cost of raising calves to the age of 9 $\frac{1}{2}$ months or the profits to be obtained, if any, by carrying them on and fattening them out at 12 months. Sixty-four calves from an Aberdeen Angus herd were selected for the purpose. The calves were born in the spring, ran with their mothers on the pastures till late autumn, were then weaned and prepared for fattening from December 21 to January 17, receiving broom-sedge hay (consisting chiefly of *Andropogon scoparius*), maize silage and cottonseed meal. On January 17, 49 of the calves were put on to fattening rations and kept on this diet until April 1st.

The average weight at 9 $\frac{1}{2}$ months was 460 lbs. and the average cost of raising the calves to that age was \$ 14.36. During the fattening period

the average daily increase was 1.37 lbs. on a ration of 4.4 lbs. of cottonseed meal, 23.9 lbs. of maize silage and 2.76 lbs. of broom-sedge hay, so that 100 lbs. of live weight increase required 323 lbs. of cottonseed meal, 1741 lbs. of maize silage and 201 lbs. of hay, costing \$ 7.3. The fat calves were sold at \$ 5.87½ per 100 lbs., while the cost of raising and fattening them only amounted to \$ 3.61 per 100 lbs. A profit of \$ 436.19 was obtained on the whole herd, or an average of \$ 6.81 per calf.

652 - **Cattle-Breeding and Dealing in Senegal.** — ADAM, J. in *L'Agriculture Pratique des Pays Chauds*, Year 14, Nos. 131, 132 and 133, pp. 65-80, 149-157 and 193-210. Paris, February, March and April 1914.

The physical conditions of the colony of Senegal make it favourable for cattle-rearing. The nearness to European ports points to beef production as the most suitable branch of the industry and from this standpoint Senegalese cattle may be divided into three groups.

1. The pure-bred Senegal zebu, humped ox, or Gobra, a Peuhlish variety of the zebu type. This is a heavy-framed breed, with a moderate beef-producing capacity, an average live weight of 750 to 900 lbs. yielding 40 to 42 per cent. dead weight of medium quality meat, not very spotted. The beef-producing capacity of the Moorish or Gabarougé variety is still smaller.

2. The N' Dama or humpless ox, which is of smaller size, but has a better-knit frame and better developed hind-quarters. The beef is of better quality than that of the zebu, and the average weight is 350 to 450 lbs. There are two varieties, the Gaboon and the Niokho, the latter being the smaller of the two.

3. The mixed type (jakoré, warlé, n'dama-match), resulting from a cross between the two preceding breeds. This type is by no means uniform, as in native cattle-raising the crossing is promiscuous, but on the whole it is a good animal for the butcher, a full-grown bullock weighing on an average 650 lbs.

The distribution of Senegalese cattle is governed by natural conditions and by the zone where trypanosomiasis is endemic. Generally speaking, the N' dama breed is by far the hardiest and the most disease-resisting, and predominates in districts where water is scarce or where trypanosomiasis is prevalent, i. e. in the districts round Bakel and Matam, while about Saldé and Podor one meets with zebus as well, and crossbreds most of all. The zebu predominates in the neighbourhood of Dagana, where, on account of adverse local conditions, it remains without much size or muscle, and also in Djoloff and Baol, where the best beef-producing zebu are found. There are crossbreds there also, while in the Mjaves, where Gobras cannot live, only crossbreds and N'damas are to be seen.

Pure bred N'damas, are predominant in the Serère Provinces, along with crossbreds, and produce good butchers' beasts, and the same applies to Sine Salum. At Niani-Ule, in Upper Gambia, and in Casamanca, they constitute the whole of the cattle. In Lower Casamanca, stock breeding is difficult, on account of the damp climate.

Senegal does not afford any well-defined stock breeding districts. Stock-breeding is distinct from crop growing, and there is a violent hostility between the two occupations. The negro races of Senegal must be classified into two divisions: first the Peuhls, who are nomadic and pastoral, and secondly the "Toucouleurs", Serères, Mandingues, Ouoloffs, etc., who have a fixed abode and till the land. Usually, Senegalese herds are subjected to a system of migration.

The centre of Senegal consists of a huge plain, called the Ierlo, intersected in various directions by sort of gulleys. Here are to be found pools and also wells or "seïanes", dug by hand at those points in the valleys where water is held up in the wet season. It is on this plain that the cattle are pastured during the wet season. As water becomes scarcer, the Peuhls return to the dry-season feeding-grounds; those from the North, North-East and East reach the banks of the Senegal, those from the West go to Djoloff, and those from Baol, to the Serère Provinces. The young stock do not take part in the migration, but remain in the encampment together with a few milch-cows.

In some regions, as for instance in parts of the Luga district and on the coast in the neighbourhood of Saloum, the herds are stationary. As a rule, the cattle of the Toucouleurs, Ouoloffs, Sérères and the various tribes of Casamanka migrate short distances. The total number of cattle in Senegal may be reckoned at 800 000 head, and there are about 150 000 butcher's beasts.

The methods of cattle-breeding in vogue among the Peuhls, as well as those practised by other natives, are crude to the last degree. They make no provision of forage to feed their stock during the dry season, so when the latter arrives they are in a very bad way, and often lose their beasts, which die of starvation. The only care the native stockbreeders do take is to water their cattle, and even then they do not get as far as selecting suitable pools, so that only too often the stock drink foul, muddy water, swarming with the larvae of parasites. The repeated privations to which they are exposed have at length rendered the Senegalese cattle adapted, so to speak, to enduring thirst. They can go two months with only one drink every two days, or even every three days, according as they may chance to come across a watering-place, and it is no small wonder that with no more care than this the Senegalese cattle give so good a return as they do.

The calves are deprived from birth of part of their mothers' milk, weaned as soon as they can graze, and fed on a bare maintenance diet all their growing period, appreciably retarding their development. It is true that they share the supplementary ration sometimes given to their mothers, but that does not make up for the lack of sufficient milk.

- 653 - **Karakul Sheep in the Argentine.** — Dirección General de Ganadería, Buenos Aires, in *Boletín del Ministerio de Agricultura*, Vol. XVII, No. 1, pp. 122-130. Buenos Aires, 1914.

SHEEP

The small herd of Karakul sheep established in the mountainous district of Azul was presented to the Argentine Government by the Emperor of Austria in 1911.

They are being bred for the purpose of obtaining a number of acclimatised pedigree rams to be used for crossing with the local or Criolla ewes. By October 1912, 25 dark-fleeced native ewes from Entre Ríos had given birth to 13 crossbred lambs, of which 9 were males; all the lambs inherited the characters of their male parent with regard to colour and curliness of the wool. The experiment was then extended to include 250 ewes brought from different parts of the Argentine, and consisting almost entirely of Criollas with the exception of a few Merinos and Lincolns. The work is being carried out on the San Nicanor estancia belonging to Dr. M. M. Torino, and has resulted in the production of 76 first generation lambs all exhibiting the Karakul fleece; the crossbred ewes will now be repeatedly crossed with the pure Karakul rams until a herd of pure Karakul sheep is obtained.

Wet, damp soil has proved very disastrous to the pure Karakul sheep, which contracted serious parasitic diseases (strongyles, sclerostomi, tricocephali). Of the total number imported in 1911, consisting of 4 rams and 16 ewes, only 5 ewes were alive in 1913. In the course of these two years 23 pure bred lambs were born, of which 8 died; both the first and second generation remained true to type without showing any signs of degeneration.

- 654 - **Fattening Pigs on Cassava.** — GOUIN, A. and ANDOUARD, P. in *Bulletin des séances de la Société Nationale d'Agriculture de France*, Vol. LXXIV, No. 4, pp. 481-483. Paris, April 1914.

PIGS

The writers, continuing Professor Frateur's experiments in feeding pigs on cassava, made some trials, and found that the method recommended by Professor Frateur might be profitable in Belgium, where cassava is obtainable for 12 or 13 francs per 100 kg. (4s 10d to 5s 3d per cwt.), but that it could not be followed in France, where cassava costs 18 fr. the 100 kg. (7s 3d per cwt.).

With a view to finding a more economic use for cassava, the writers made some experiments of their own, with the following results.

1. In the case of pigs fed with milk as well, it only took 3 lbs. of cassava to produce a gain in live weight of 1 lb., instead of the 4.18 lbs. of cassava required at Louvain.

2. By substituting for the milk ration 1.1 lb. of rice gluten and 2 ½ oz. bone meal, which costs 1d and is equivalent to 1 gallon of separated milk, there is required, to produce a gain of 1 lb. live weight, only 2.9 lbs. of cassava.

In practice, the profit exceeded 40 per cent.

Professor Frateur fed the cassava to the pigs in slices, cooked and then crushed. The writers fed it raw. It had been previously chopped fine in the colony itself.

655 - **The Influence of the Male Parent on the Character of the Egg-shells in Fowls.** — WALTHER, A. R. in *Landwirtschaftliche Jahrbücher*, Vol. 46, No. 1, pp. 89-104. Berlin, March 11, 1914.

In an investigation on the heredity of certain characteristics in fowls, it was sought to determine to what extent the breed of the cock influences the weight, shape, gloss and colour of the hens' eggs.

More than 130 eggs were laid by 13 hens, mated, some with cocks of their own breed, and some with cocks of 4 different breeds.

The breeds employed were the following :

I. *Dwarf fowls.*

1. Japanese: 1 cock, 2 hens.
2. Millefleur: 1 hen.
3. Silver-Sebright-Bantam: 1 hen.

II. *Medium-sized fowls.*

1. Huringian "Pausbäckchen": 1 cock, 3 hens.
2. Westphalian "Kruper": 1 cock, 3 hens.
3. "Nackthäse": 1 cock, 3 hens.

All the dwarf hens were reckoned as belonging to the same race, in view of the difference in weight between them and those of medium size. All the hens were first mated with cocks of their own breed; then the cock was removed and an interval of 8 or 10 days was allowed to elapse before he was replaced by a cock of another breed.

All eggs laid during the first mating period and subsequent isolation are reckoned as pure, while crossed eggs are those laid after the 10th day of the presence of the cock of another breed. Between the removal of the first cock and the time when the second cock's influence began to be felt, a space of time elapsed which the experiment shewed to be long enough to make sure that the influence of the first cock had entirely disappeared. The eggs were weighed and measured, and their colour and gloss noted as soon as possible after they were laid, and particulars were only kept of those eggs which proved fertile on incubation.

The results may be summarised as follows: The fact of the cock belonging to a different breed had no influence upon either the weight, shape, colour or gloss of the eggs. The writer therefore casts some doubt on the recent assertions of Holdefliess and Tschermak, in which those writers allege that they have observed in eggs phenomena indicating telegony.

POULTRY

656 - **Seaweed for Packing Birds.** — DEKOBRA, M., in *La Nature*, No. 2134, pp. 339-340. Paris, April 18 1914.

In speaking of the utilization of a species of "mutton-bird", the writer describes a new method of packing; this consists in placing the body in a natural bag formed by the lamina of a certain seaweed occurring in islands off New Zealand. Birds can be kept in good condition for several years in this way.

657 - **Ostrich-farming in New Caledonia** — FRAYSE, A. in *Revue de la Chambre d'Agriculture de la Nouvelle-Calédonie*, No. 39. pp. 26-30 Nouméa, March 1914.

A colonist in New Caledonia has started ostrich farming with nine imported birds. The price of the birds was £ 32 a piece, and the total cost of importation was £ 1000. Ostriches could be had in Australia at a price of £ 40 to £ 48 the pair.

658 - **Poultry-Farming in Canada.** — FORTIER, V. in *La Vie Agricole et Rurale*, Year 3, No. 16, pp. 434-435. Paris, March 21, 1914.

The writer describes the excellent results achieved for some years now in Canada with the system of unwarmed fowlhouses. Both from the point of view of preventing disease and from that of maintaining the birds in good condition, experience shews that it is better not to heat fowlhouses in winter. Among other good effects this system increases vitality and laying-power. It is sufficient that fowlhouses should be built well protected from damp, and that, at the beginning of the cold season, the fronts should have sacking or coarse cotton drawn over them, so as to keep out draughts. The fowlhouse should be built facing south, which greatly raises the temperature inside (when the thermometer outside shews 23° below zero Centigrade, the temperature inside will be 3° or 4° C. on a sunny day or 0° to 2° C. on a dull day). The house should be fitted with flat perches, to admit of the fowls covering their feet completely with their feathers. For laying purposes trap-door nests should be used, and should be visited often enough to prevent the eggs having time to freeze. This system has contributed largely to the recent great progress of Canadian poultry farming, the receipts from which have increased, under the encouragement of the Government, from £3 385 000 in 1901 to £7 842 000 in 1911.

FARM ENGINEERING.

659 - **Automatic Lifter for Balance Ploughs.** — DE CONDÉ, FERNAND in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 113, Vol. 121, No. 1. Paris, January 1914.

In working with heavy balance ploughs, lifting the shares out of the ground at the end of the furrow is often very laborious. In Bajac's plough the work is done automatically. In fig. 1 the balance plough is shown travelling in the direction of the arrow. To the landside of the frame a sector shaped piece S is attached by means of a horizontal axis x round which it can revolve. While the plough is proceeding, the sector S is kept in the position shown in fig. 1 by a catch. On nearing the end of the furrow the ploughman, without leaving his seat, releases the catch by pressing his foot on a pedal, and at the same time he steers the plough so as to bring the wheel A on to the unploughed land. The sector then falls into the position S, fig. 2, touching the unploughed land with the point a ; the radius of the curve ab of the sector increasing from a to b causes the point x to rise as the machine advances and this, combined with the

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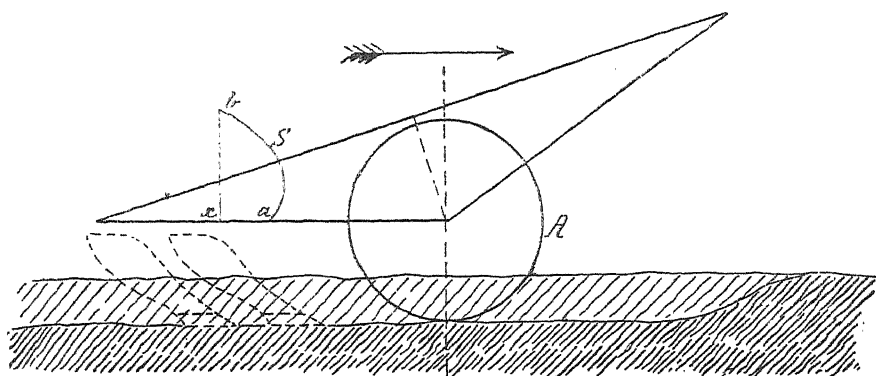


Fig. 1.

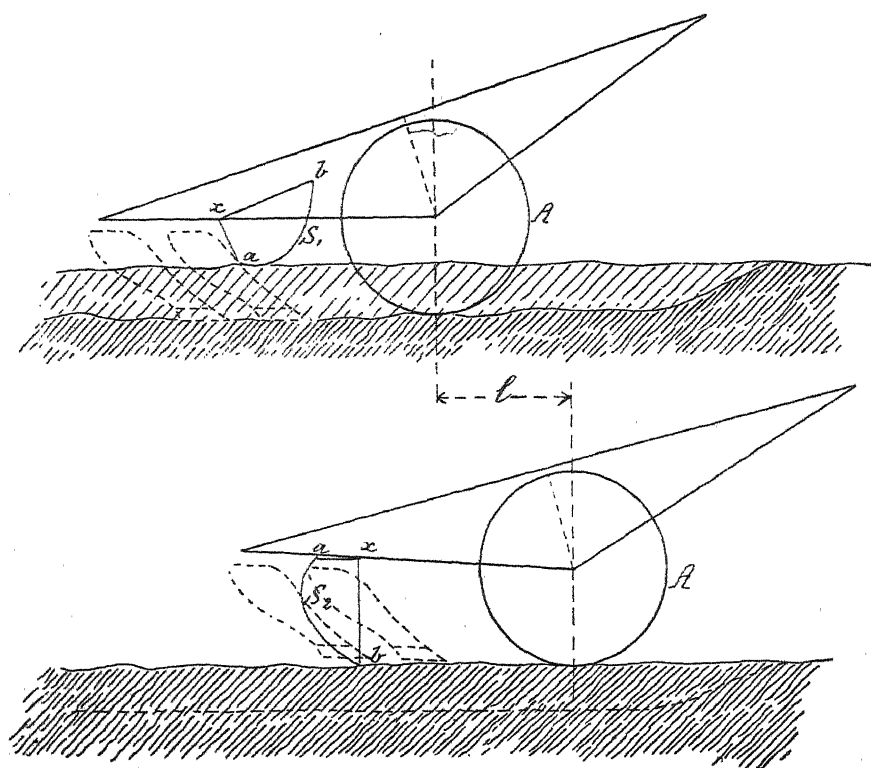


Fig. 2.

rising of the wheel *A* on the land lifts all the shares out of the ground within a length *l* equal to the development of the curve *ab*, fig. 2.

In order to prevent the sector slipping or dragging it is provided with strong projecting cleats.

When the plough is tilted for the return journey the sector is lifted by hand into its original position in which it is caught and fixed by the catch.

660 - **Team-hauled and Self-propelling Motor Binders.** — RINGELMANN, MAX, in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 2, pp. 55-57. Paris, January 8, 1914.

In order to determine independently the power required by motors for working reaping and binding machines, *a*) when self propelled and *b*) when hauled by a team, the writer gives the following data drawn from a number of experiments carried out with various binders working in level fields.

A. The total amount of work done by a binder in travelling, reaping, binding and overcoming the friction of its mechanism ranges on average

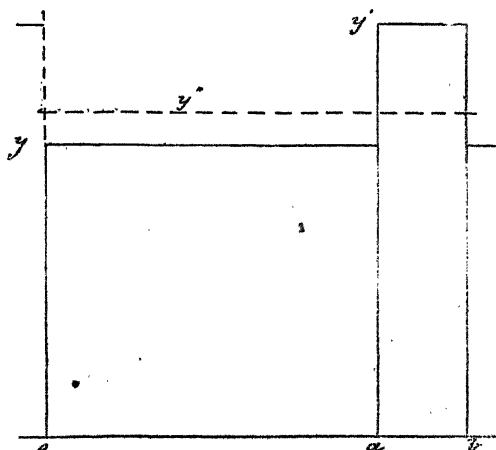


Fig. 1. — Diagram of a cycle of work done by a reaper and binder.

between 656 and 755 foot-pounds per pound of sheaves of wheat, and between 525 and 623 foot-pounds per pound of sheaves of oats.

B. The work of binding a sheaf of wheat weighing 11 lbs. requires an average expenditure of from 330 to 240 foot-pounds, which includes driving the mechanism, packing the cereal, knotting and cutting the twine and discharging the bound sheaf.

C. In machines having a five-foot cutter-bar, working in practice a swath of 4ft. to 4ft. 4in. on the level, and with a crop of about 44 cwt. of sheaves to the acre, the average power varies according to the various phases of the work and may be represented by the diagram, fig. 1, in which the distance travelled by the machine is shown by *oa* and *ab* and the power employed by *oi* and *ay*.

1) For a certain space oa the machine works as a simple reaper with elevator; the average traction oy is then 343 lbs.

2) At the end of this period there are 11 lbs. of cereals on the binder deck. The binder gets thrown automatically into gear and works while the machine travels from a to b and requires a power ay' , about 495 lbs.

3) The mean for the whole cycle, *i. e.* for the whole distance ob , is 380 lbs.

But the power required during the two periods is not constant throughout each period. Its variations are shown in fig. 2.

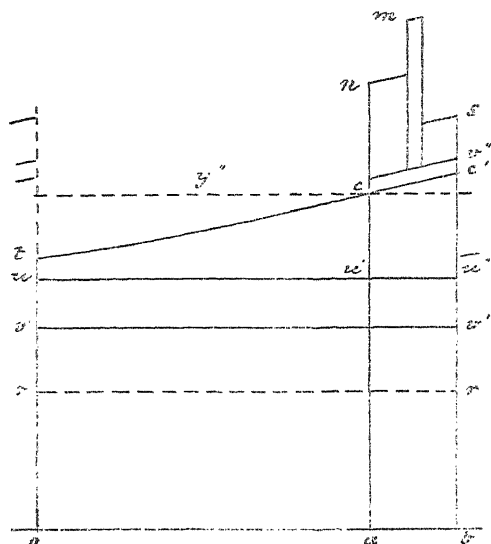


Fig. 2. — Diagram of the variations of power required by a reaper and binder during a cycle of work.

During the first period oa (when the binder is not working) the following work is done :

or haulage of the machine.

wv power consumed by the various parts of the machine itself minus the binder running empty. Everything above the line wv represents the work done in passing the cereal through the various parts of the machine ; thus vu is the work of bending down the grain to the cutter-bar, cutting it and carrying it by the platform and elevator canvasses.

$utcu'$ is the work of the packers up to the moment ac when there is enough grain on the deck to throw the binder into gear.

In the second period ab there are besides these demands, all those above cc' required by the binder proper, to which must be added $w''c'$, or the power which presses the cereal, continually supplied by the elevator canvas, against the back of the needle and the sheaf which is being tied.

$cc'v''$ the working of the binder proper running empty.

n the average work of the needle and twine going through the compressed sheaf.

m the knotting.

s cutting the twine after the knot has been tied, the descent of the needle and the discharge of the sheaf by the carriers.

The team or the motor have thus to supply during a short time a maximum amount of work shown in m in fig 2. In reality the dynamometer diagrams reveal that in some moments the power required is still greater.

D. Assuming however the average traction required to be represented by y'' in figs. 1 and 2, it has been found that a binder weighing, with its driver, about 1700 lbs., cutting a swath of 4ft. 2in. and dealing with a crop of 44 cwt. per acre, requires an average traction power of :

For the haulage of the machine	169.4 lbs.
For working the machine running empty.	90.2 »
For reaping and binding	121.0 »
average total	380.6 lbs.

which, at a speed of 4 ft. per second, corresponds to about 1502 foot-pounds per second or about $2\frac{3}{4}$ HP.

Taking the above data as a basis and making due allowance for shocks, sudden strains and maximum efforts, the writer calculates that if the binder is drawn by a team, the motor required to work the reaping and binding mechanism must be capable of developing not less than 4 HP, while if it has also to propel the machine, the motor must be a 14 or 15 HP one, in order to be able to cope with the gradients and inequalities of the ground often met with in fields.

661 - **Rubber-testing Machinery at the Imperial Institute.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 76-79, 4 plates. London, January-March 1914.

It has been felt for some time that the present methods of judging the quality of rubber in the sale room are exceedingly crude and unsatisfactory and that accurate data for comparison can only be obtained by careful scientific investigations.

The best and most trustworthy method of judging rubber is to vulcanise a portion and to submit the vulcanised product to mechanical tests. Some work has been done in this direction, but much further investigation is required before the question of the best method for the preparation of rubber can be solved. Recognizing this fact, the Rubber Research Committee of Ceylon, in cooperation with the Department of Agriculture in the Colony, has arranged with the Imperial Institute to conduct a complete investigation of the effect of different methods of preparation on the quality of the rubber.

For this purpose there has been installed at the Imperial Institute a complete experimental vulcanising and testing plant, consisting of a washing machine, a mixing machine, a three-bowl calender, a vulcanising press, a vulcanising pan, a vacuum drier and a gas-fired boiler, and embodying all the most recent improvements which have been suggested by experience.

For the determination of the mechanical properties of vulcanised rubber one of Schopper's testing machines, which are considered to be among the most efficient, has been obtained. It can be used to determine the breaking strain, the elongation with fixed load, the load required for fixed elongation, etc. The machine is also fitted with an automatic apparatus for drawing diagrams. Other testing machines will be added during the progress of the investigations.

It is anticipated that by these means much light will be thrown on the effect of different methods of preparation on the quality of the rubber, and will enable a method to be selected on the plantations which will produce rubber of the highest possible quality.

662 - **The Motor Plough Trials at Litowitz and at Komotau Hagensdorf.** — WIRTH, HEINRICH in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 3, Part 2, pp. 67-79. Berlin, 1914.

In Austria, where the scarcity of agricultural labour is as keenly felt as in Germany, the question of efficient motor ploughs raises a good deal of interest. Two trials of these machines were held in the autumn of 1913, at Litowitz and at Komotau-Hagensdorf in Bohemia, and their results are given at some length in the above paper, from which the following data are taken :

I. *Trial of motor ploughs at Litowitz on medium heavy soil.* — The following firms took part in the trial carried out on September 9 and 10, 1913.

1. JOHN DEERE, with the "Twin City", 45 HP, 4-cylinder direct tractor, 500 to 650 revolutions, and eight-furrow gang plough. Width of land worked 9 ft. 4 in. Price £1250, including eight-furrow plough.

2. I. H. C., with "Mogul", 60 HP, 2-cylinder direct tractor, 350 revolutions, with 1 HP auxiliary motor. Eight-furrow Moline gang plough. Width of work 9 ft. 4 in. Price £1167, including plough.

3. HOFMEIER-SCHRANTZ-CLAYTON SHUTTLEWORTH, with "Hart Parr", 60 HP, 2-cylinder direct tractor, 300 revolutions, benzol, oil-cooling, Deere eight-furrow gang plough. Width of work 9 ft. 4 in. Price £1458.

4. ANTON DOBRY, with a 25 to 28 HP, 4-cylinder direct tractor on Saunderson's system, 550 revolutions; three-furrow Sack plough. Width of work 3 ft. 4 in. Price, £833.

5. ERSTE BOHEMISCH-MAEHRISCHE MASCHINENFABRIK, with the self-contained 32 HP, 4-cylinder motor plough "Praga", 1200 revolutions, five-furrow Joh. Cervinka ploughs. Width of work 4 ft. 8 in. Price £788 with two sets of ploughs.

6. MÜNCHENER MOTORENFABRIK (Munich-Sendling), with a 30-35 HP 2-cylinder direct tractor, 480-500 revolutions, five-furrow Eberhardt plough. Width of work 4 ft 10 in. Price £646.

7. STOCK-MOTOREPFLUG-GESELLSCHAFT, with self-contained 42-50 HP, 4-cylinder motor plough, 720 revolutions, six-furrow Stock plough. Width of work 6 ft. 8 in. Price £1104.

8. CASE THRESHING MACHINE CO., with a 40 HP, 2-cylinder direct

TABLE II.

	Mogul 60 HP.		Hart Parr 60 HP.		Case 40 HP.		Twin City 45 HP.		Stock 42-50 HP.	
Date : September 1923	14th	15th	14th	15th	14th	15th	14th	15th	14th	15th
Area actually ploughed, acres	3.46	2.30	3.62	2.43	3.70	2.47	3.70	2.40	3.70	2.47
Inclination of field	partially slightly in- clined	level	partially slightly in- clined	level	partially slightly in- clined	level	level	level	level	level
Fuel, S. G. at 15° C.	Benzin 0.723	Benzin 0.730	Benzol 0.861	Benzin 0.732	Benzin 0.736	Benzin 0.737	Benzin 0.734	Benzin 0.745	Benzin 0.733	Benzin 0.732
Net time at work, hours and minutes	2 h. 17 m.	1 h. 51 m.	2 h. 42 m.	2 h. 31 m.	3 h. 5 m.	2 h. 39 m.	3 h. 22 m.	2 h. 30 m.	1 h. 43 m.	2 h. 9 m.
Depth of furrow . . . in.	7.09	9.06	7.49	8.27	5.91	5.52 to 7.88	6.03	8.27	6.70	8.51
Breadth of work . . . in.	102.36	78.74	53.54	54.72	57.09	50.39	57.09	53.54	80.71	55.51
Number of ploughs working	7	6	4	4	4	4	4	4	6	4
Speed per sec, ft. in. . .	2 ft. 11	2 ft. 4	3 ft. 3	2 ft. 11	3 ft. 3	2 ft. 4	3 ft. 7	3 ft. 1	4 ft. 9	3 ft. 2
Calculated averages per acre :										
Time, hours and minutes	40 m.	49 m.	45 m.	1 h. 12 m.	50 m.	1 h. 4 m.	38 m.	1 h. 2 m.	28 m.	52 m.
Fuel lbs	29.4	23.55	46.56	44.60	25.42	30.06	32.47	40.59	22.30	23.99
Water for cooling lbs	158.78(1)	91.88	oil cooling		5.35	12.58	4.73	8.30	2.99	3.12
Performance per day of 10 hours acres	15.14	12.35	13.49	9.63	11.98	9.34	15.56	9.71	21.49	11.51
Estimated average per day of 10 hours, without interruptions acres	16.05	12.35	13.58	11.11	12.35	?	13.58	10.37	21.49	11.61

(1) At each stoppage some water was lost.

tractor, 450 revolutions, Deere six-furrow plough (Inlands type). Width of work 7 ft. 6 in. Price £925, including 6-furrow plough.

All the above machines are provided with differential gear to enable the wheels to revolve independently of each other in turning, and with reversible motion. To prevent skidding most of the engines are fitted with fixed or removeable projecting cleats, besides fixed or removeable fly wheels to enable them to drive other machines. They are all easy to steer.

The object of the competition was to ascertain the amount and quality of the work done, and to this end a large field was divided into eight adjoining plots of the same shape and size, one for each machine. The first day the ploughing was done on the level, in the morning to a depth of 6 inches, in the afternoon to about 10 inches. The next day (September 10) the ploughing was done on an inclined field. September 9 was a fine sunny day but in the night 0.16 in. of rain fell.

On the first day a wheat and barley stubble was ploughed; the soil was a medium loam, dry on the surface. Each of the ploughs was given 5.2 acres to plough. The data obtained are given in Table I, and from these the work done per hour and the consumption per acre of fuel and of water for cooling were calculated. In consulting these figures, however, it must be borne in mind that the conditions were not all invariably the same throughout the tests. Thus in the morning the tractors on reaching the end of the furrow lifted the shares out of the ground and returned running empty, while in the afternoon they ploughed all round. Further, in the afternoon several of the outfits reduced the number of ploughs in the gang. The depth of furrow was not the same in all cases. There may also be some errors in the observations, which tell all the more as the duration of the trials was short. As for the quality of the work, the turning over of the soil was good throughout, with the exception of the "Praga" plough, which in shallow ploughing was not satisfactory. Uniformity of depth was attained better by the direct traction ploughs than by the self-contained ones. The loosening and crumbling of the soil was sufficient in all cases, with the exception of the "Praga" in shallow ploughing. Observations were also taken of the appearance of the ploughed land one week after the tests and after a rainfall of 2.2 in.

On the second day, September 10, the field to be ploughed was a wheat stubble, medium loam and sloping towards the south, the gradient being about 9 in 100. To each outfit 2.47 acres of land were assigned. The work done was similar to the deep ploughing of the preceding day. The ploughing in of the stubble was not quite satisfactory, nor was the loosening of the soil, especially in the case of the heavy tractors, which compressed the soil. "Praga", "Stock" and "München-Sendling" crumbled the soil very well. The traction ploughs required two men each, the self-contained ploughs only one.

II. *Trials at Komotau-Hagensdorf (on very heavy soil).*—On September 14 and 15, motor plough trials took place on Herr E. Harsch's estate at Hagensdorf near Komotau. The machines entered were the following; International Harvester Co's "Mogul" (60 HP); Hofherr-Schranitz-Clay-

ton Shuttleworth's "Hart Parr" (60 HP); Case Threshing Machine Co's 40 HP tractor plough; John Deere's "Twin City"; and Stock's motor plough.

On both days barley stubble was ploughed; the heavy humous clay was in good condition with regard to moisture. On September 14 the soil was not quite the same for all the machines, the I. H. C. plough getting the heaviest, the Stock the lightest and the others occupying the same intermediate positions as in Table II. On September 14, each machine was given a plot 3.7 acres in extent, on the 15th 2.47 acres. The resistance of the soil on the second day was very nearly the same for all plots.

The competing machines were to have ploughed to a depth of 6 inches on the first day and 10 inches on the second. On both days the ploughing in of the stubble and turning over of the soil, as well as the loosening of the soil, was satisfactory. The data concerning the performance of the machines are given in Table II (p. 925).

663 - **A Self-Steering Farm Motor.** — WASHBURN, H. J. in *The Scientific American*, Year 70, Vol. CX, No. 15, p. 313. New York, April 11, 1914.

A great need of the country is an efficient helper for the owner of the one-man farm, a machine that will work effectively and make him less dependent upon hired help, while saving him a considerable outlay in wages. Such a system has been devised on a practical basis. It requires compliance with certain conditions which cannot be fulfilled on all farms, but which are an easy matter in some existing ones and in many new localities.

The farm must contain one or more circular areas of any size up to about 10 acres each, reasonably level.

Thus a 10-acre farm would have a 7-acre circle in its centre, the remaining corners, 3 acres in extent, being occupied by fruit trees, buildings, etc. In the centre of the circle the post shown in the figure (facing p. 928) would be permanently erected. At the top of this post, which is strongly guyed, is seen an iron drum. This drum is set and locked by the handle on the side of the standard. Attached to the drum is a slender galvanized steel wire; it passes through a guide pulley and then to the steering lever of the motor-driven implement at some distance away. At each revolution of the implement round the field the wire wraps once round the drum, hence the circumference of the drum determines the width of work done. Between the frame and the steering lever of the implement a strong spring is attached, tending to steer the implement away from the centre post. The steering wheel has a deep flange in order to resist side pressure. About two pounds pressure at the end of the steering lever is sufficient to guide the implement. Since the tension of the spring and of the wire opposing it is about 50 lbs., the steering lever is obliged to follow an exact spiral path.

Repeated runs with the implement, starting at a radius of about 200 feet and finishing about 20 ft. from the post, showed no visible variation from its course. The steering action was very dependable, requiring no attention whatever.

The framework of the implement is intended to be such as will facilitate the attachment of all the devices used in row-crop farming, such as ploughs, ridgers, cultivators, sprayers, etc.

An improved style of implement has been designed, having motive power applied to both rear and forward wheels, both of them being pivoted so as to work between closely set rows of plants. The height under the beam is about 3 feet, permitting the cultivation of tobacco, cotton, etc., of that height. A safety device is provided to stop ignition in case of breakage of the steering spring or wire. With a dependable motor two six-hour runs per day *without an attendant* are possible.

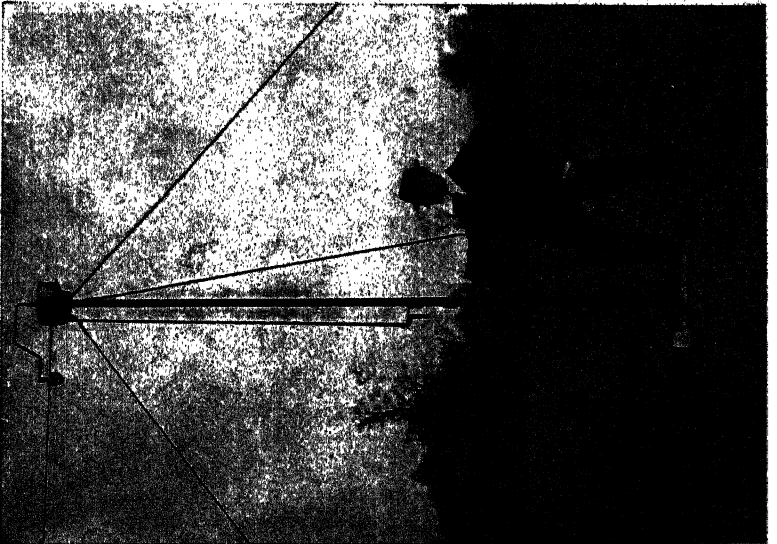
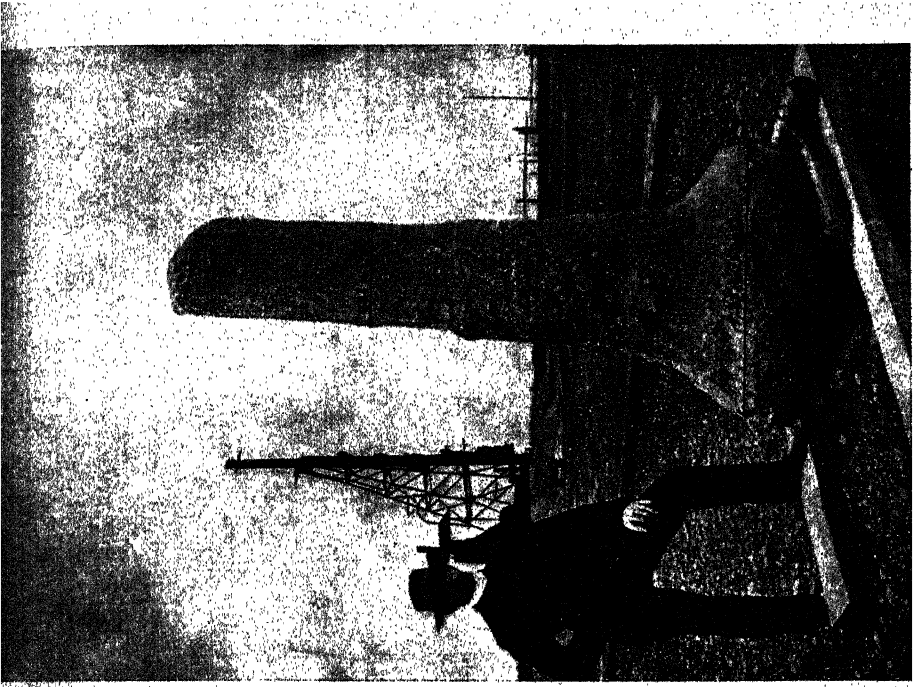
**BUILDING
CONSTRUCTION**

664 - **Foundations on Explosion Piles in Compressible Soils.** — BEAUMONT, P. in *Revue Industrielle*, Year 45, No. 12, pp. 155-158. Paris, March 21, 1914.

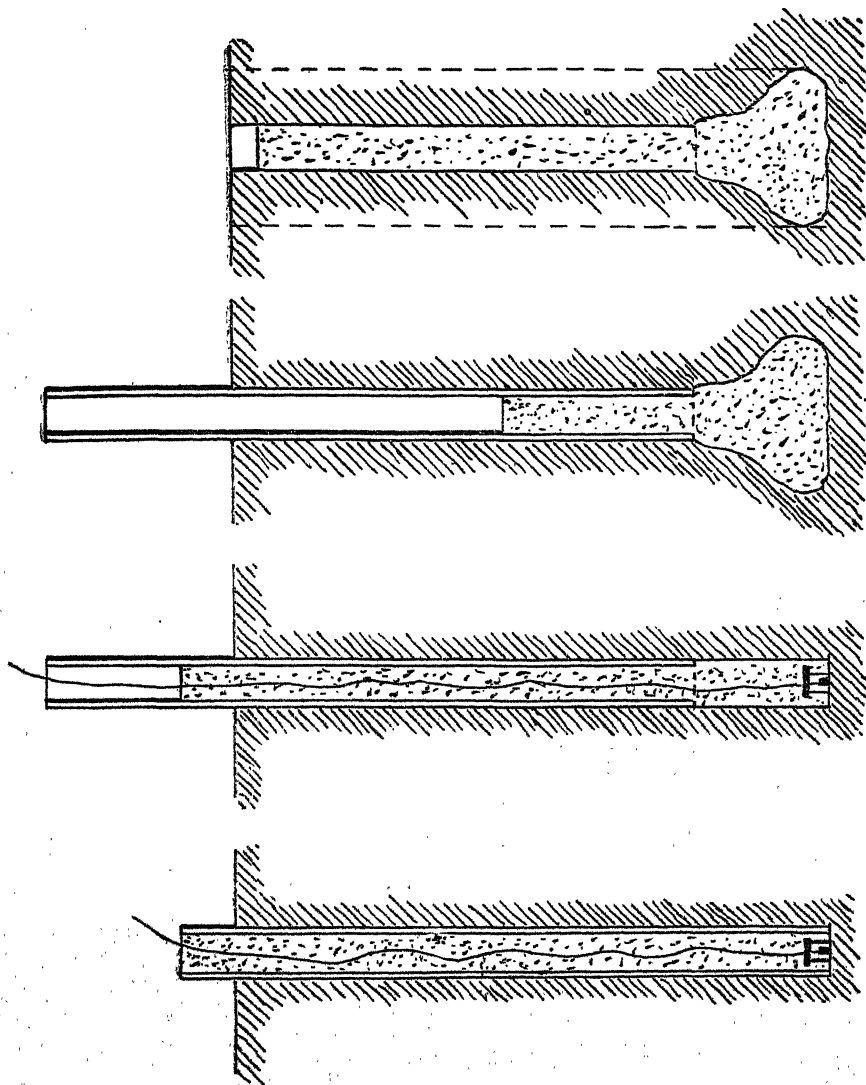
Compact and resistant soils allow the foundations of buildings to be laid directly upon them, but such soils are rarely found at the surface; they are generally situated at varying depths and frequently so low down as to be practically beyond reach. In these cases recourse is had to: 1) a continuous simple or reinforced concrete foundation; 2) timber or concrete piles rammed by a pile driver; 3) concrete piles built on the spot.

The first system can be adopted only where the load to be borne is moderate and uniformly distributed and where there is no danger that the ground will be disturbed or undermined; it is, besides, expensive. Timber piles, among other drawbacks have that of being conical in shape and provided with a pointed iron shoe, both of which conditions cause them to tend to sink deeper into the ground under the weight of the building; if, on the other hand, they reach a sufficiently resistant layer they are liable to break under the blows of the ram and thus to become useless. The same defects are met with in the concrete piles driven in by ramming, and these are still more apt to break than the timber ones. Furthermore they require at least three months to set before being used and they are expensive.

Wherever possible it is therefore an advantage to use concrete piles built where they are to stand, and to replace their pointed extremity by a base much larger than the rest of the pile. With the explosion pile a base having a large bearing surface is obtained together with an artificial compression of the surrounding soil which greatly increases its resistance. These piles are made as follows: a special steel tube encasing a timber pile is driven into the ground to the required depth by means of a pile driver. The timber pile is then withdrawn and the explosive cartridge is let down to the bottom of the hole in a special patented apparatus which has the object of protecting it and of directing the force of the explosion in a horizontal direction. The steel tube is then filled with fresh cement concrete (fig. 1) and lifted about 3 ft. 3 in. from the bottom (fig. 2), after which the charge is fired. The concrete sinks instantly and fills the chamber formed by the explosion (fig. 3). All that then remains to be done is to pour concrete into the tube, raising the latter gradually, and at last to remove it altogether, and the result is an explosion pile with a large and resistant base surrounded by, and resting on, strongly compressed ground (fig. 4).



There is no difficulty in regulating at will the size of the foot of the pile and the compression of the ground around it. The cubic contents of the chamber caused by the explosion are easy to calculate, being equal to the



difference of volume of the concrete in the steel tube before and after the explosion. Thus after a few trials the most suitable charge can be determined. It should be noted that with these piles the foundation is not repre-

sented only by the cross section of the pile, but by the section of the whole heterogeneous cylinder of earth and concrete shown by the dotted lines in fig. 4. If the soil is very bad and the load considerable, several of these piles can be grouped together, in which case the soil around their bases gets so compressed as to approach the hardness of concrete. Fig. 5 (facing p. 928) taken from a photograph of one of these explosion piles.

RURAL ECONOMICS.

665 - **The Economic Limit of Sugar-Beet Growing.** — BERNARD, P. in *Le Progrès agricole*, Year 28, No. 1392, pp. 229-230 and No. 1393, pp. 249-250. Amiens, March 22 and 29, 1914.

One of the most important factors influencing the profitability of sugar-beet growing is the cost of transport, which depends principally upon the distance the beet has to travel on its way to the factory.

The writer determines the outside limit of this distance at the prices now ruling in France. He endeavours first to ascertain the cost of the "mile ton" of beets. In a farm of 494 acres consisting of:

Wheat	118.5	acres
Other cereals	59.0	"
Beets	118.5	"
Clover	59.0	"
Meadows	99	"
Lucerne	40	"

on a 6-year rotation, the carting is as follows:

	Horse-days	Weight carted
Farmyard manure for beets	432	1 417 tons
Lime and artificials	25	83 "
Liquid manure to the meadows	64	165 "
Cereal harvest	114	566 "
Haymaking, clover	33	165 "
" meadow	20	98 "
" lucerne	150	492 "
Carting sugar beets, mangolds and their leaves	792	5 197 "
Carting cereals to railway	30	110 "
Total . . .	1 660	8 293 tons

If the average distance of this carting be taken at 2 kilometers (1.24 miles) this farm has to provide for 10 283 mile-tons in 1660 horse-days. The farm requires 4690 horse-days for all the agricultural work of the farm, and as the total cost of the upkeep of the necessary teams amounts to £1011, the cost of carting 10 283 mile-tons is $\frac{1011 \times 1660}{4690} = £357$ 16s, and

for one mile-ton $\frac{357 \cdot 16 \cdot 0}{10 \cdot 283} = 8.35$ d. If instead of 2 kilometers, 1.5 kilometer (0.9 mile) be taken as the average distance of the carting, other conditions being equal, the cost of transport per mile-ton amounts to 11d. The writer therefore considers that he is not far wrong when he assumes

the average cost of transport for a beet farm at 0.60 fr. per kilom.-tonne (9.81d per mile-ton).

The average cost of production of sugar-beets per acre is calculated as follows :

	£	s	d
Rent	1	5	8½
Interest on capital invested, at 4%	—	9	0
Farmyard manure, 40 tons, of which $\frac{2}{5}$ are debited to the beets	2	11	2
Artificial	2	14	7½
Preparing the soil before sowing	1	0	10½
Value of seed and sowing	—	14	5½
Hoing and singling	1	2	6
Lifting and loading	—	19	3½
Sundries	—	8	0
Total	£11	5	7½

To this cost of production the cost of carriage has to be added. If the beet crop be estimated at 11.94 tons per acre (30 tonnes per ha.), it means that a weight of 15.13 tons has to be carted to the factory on account of the earth adhering to the beets. At a cost of 9.81d per mile-ton, the cost of transport amounts to $9.81d \times 15.13 = 12s\ 4d$ per mile. Thus the following table has been drawn up, showing the profit or loss per acre of beets grown, according to the distance between the fields and the factory, when the sale price of the beets is $22s\ 3\frac{1}{4}d$ per ton.

Distance from fields to factory	Cost of carriage			Total outlay per acre			Profit (+) or loss (—) with an income of $22s\ 3\frac{1}{4}d \times 11.94$ = £13 6s p. acre		
Miles	£	s	d	£	s	d	£	s	d
1	—	12	4	11	17	11½	+	1	8 0½
2	1	4	8	12	10	3½	+	15	8½
3	1	17	0	13	2	7½	+	3	4½
4	2	9	4	13	14	11½	—	8	11½
5	3	1	8	14	7	3½	—	1	1 3½
6	3	14	0	14	9	7½	—	1	13 7½

The point at which beet growing no longer pays lies at a distance between three and four miles from the factory. One means of extending this limit would be the granting of indemnities for carriage, proportional to the distance covered, as is already being done by the Meaux sugar factory. The substitution of mechanical for team haulage would also lower the cost of carriage; two 24-HP motor lorries, whose performance would amount to 48 132 mile-tons in 300 days, would work at a rate of 1.96d and 2.42d per mile-ton respectively. As the lorries would only have to deal with 10 302 mile-tons and would therefore be utilized during only a limited part of the year, these figures would have to be increased, but even if they were doubled a considerable saving over team haulage would be effected.

666 — **Work and Wages of Foreign Labourers in Prussia.** — GROSSMANN in *Georgine, Land- und Forstwirtschaftliche Zeitung*, Year 7, No. 28, p. 248. Königsberg, April 4, 1914.

The foreign labourers who come for the season are generally put on piece work at hoeing, harvesting, cutting green crops, pulling roots or lifting potatoes. The following are the most usual wages.

	I. With partial board : potatoes, milk and bread				II. With full board			
	Beets		Mangolds		Beets		Mangolds	
A. Hoeing.								
1. Per acre of roots:								
a) First hoeing	3s	2d	2s	4d	2s	4d	2s	0d
b) Hoeing between the rows	2	4	2	4	2	0	2	0
c) Singling	4	0	3	2	3	2	3	2
d) Second hoeing	4	0	3	2	3	2	3	2
e) Third hoeing	4	9	3	2	4	0	3	2
2. Per acre of potatoes.		4s		0d		3s		2d
3. Per acre of grain		4s		0d		3s		2d
4. For work after the horse-hoe the above prices are diminished by 9d per acre . .								
B. Cutting green crops and harvesting.								
1. Reaping winter grain, per acre		4s		9d		2s		4d
2. Binding, stooking and carrying winter grain, per acre		4		9		1		7
3. Reaping spring grain, per acre		2		4		2		0
4. Binding, stooking and carrying spring grain, per acre		2		0		1		7
5. When working after a reaping machine the above prices are diminished by 4d per acre								
6. Mowing meadow grass, clover, lucerne, serradella or lupins, per acre		2		4		1		10
C. Pulling roots.								
	Beets		Mangolds		Beets		Mangolds	
1. Roots: Pulling, topping, heaping, clamping, and covering clamps	22s	6d	14s	3d	19s	0d	12s	9s
The same after a root-lifting machine . .	19	0	11	0	16	0	9	6
2. Roots: Pulling, topping, heaping, and either building small clamps for carting or loading on carts	19	0	9	6	16	0	8	0
The same after root-lifting machine . .	16	0	8	0	12	9	6	6
3. Covering the clamps with earth to a depth of 12 inches, according to the nature of the soil; per running foot.		7	8d to	1 ¹ / ₂ d		7	8d to	1 ¹ / ₂ d
4. Pulling swedes, as at C2, per acre . . .		9s		6d		8s		0d
D. Potatoes.								
1. Digging, per 110 lbs.		2 ¹ / ₂ d				1 ³ / ₄ d		
2. If preceded by the potato-plough, the price is reduced by ¹ / ₂ d per 110 lbs. . .								

667 — **Cost of Production of Milk and Beef.** — WATERSTADT, F. in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 1, pp. 137-156. Jena, 1914.

The writer reports certain results of observations made on the cost of production of milk and of meat, and discusses the factors which influence these values in the various systems of farming. In one Table (see Table I) he collects the most important results from seven dairy farms where the farmers raised no stock of their own (Abmelkwirtschaften) and from seven others where they only raised a portion (Halbabmelkwirtschaften). These farms are placed in ascending order of cost of milk production.

TABLE I. — *Results from 7 Dairy Farms where none of the stock was raised and from 7 where some of it was raised.*

No. of Farm	Per Cow per Farm					
	Cost of feeding M.	Labour M.	Gain or loss of flesh M.	Total expenditure M.	Gross return M.	Cost of producing 1 gallon of milk pence
<i>Farms where no stock was raised.</i>						
1	531.2	60	— 1	702	718	6.2
2	512	60	+ 1	641	677	6.7
3	534	58	— 39	695	684	6.9
4	472	57	— 45	634	620	7.0
5	533	57	— 42	682	654	7.25
6	538	53	— 50	703	669	7.6
7	530	55	— 120	768	683	8.4
Average . . .	521	57	— 42	689	673	7.2
<i>Farms where some of the stock was raised.</i>						
1	310	58	+ 16	427	475	5.3
2	316	58	+ 19	446	465	5.8
3	347	65	— 5	468	466	6.2
4	414	58	— 4	553	548	6.4
5	389	65	— 32	550	544	6.9
6	420	53	+ 13	548	468	7.3
7	437	68	— 32	593	507	8.0
Average . . .	376	61	— 9	512	496	6.6

It is seen from Table I that on dairy farms where none of the stock is raised, in spite of the increased cost of milk-production, the cost of feeding and the labour bills are very little changed. On the other hand it is clearly shown that unfavourable results (*viz.* excessive cost of milk-production) are connected with the difference between the cost-price and the sale-price

of the cows. In the case of the dairy farms where a portion of the stock is raised, the chief factors influencing the cost of milk-production are the increasing cost of feeding and the milk-yield.

The results from nine dairy farms where the stock is raised on the farm are collected in Table II.

TABLE II. — *Results from 9 Dairy Farms where the stock is raised.*

Farm	Milk yield gallons	Gross return M.	Gain (+) or loss (—) M.	Cost of produc- tion, pence per gallon	Sale price, in pence per gallon	Cost of feeding M.
A	616	723	— 113	10.4	6.3	372
B	670	642	— 36	9.6	7.25	442
C	653	580	— 59	8.5	5.9	401
D	722	661	+ 3	6.9	7.0	438
E	724	672	+ 58	6.3	6.6	347
F	736	661	+ 58	5.4	5.7	303
G	788	891	+ 67	6.2	6.6	350
H	425	365	— 51	10.25	5.5	288
I	434	540	— 186	13.2	5.5	365

The three first farms shew a deficit, a result attributable to the high cost of milk-production. Whether a farm pays depends also on the milk-yield, as appears from a comparison of the figures for B with those for A and C. This interpretation is confirmed by the results from the other farms, of which four, having high milk-yields, realize a profit. The two last farms experience a loss, due to their poor milk-yield. The cost of feeding has also its significance with reference to cost of production. Thus for farms D and F, the gross returns are the same and yet the cost of milk production is very dissimilar. The writer lays stress on the fact that on the four farms where a profit was realized the feeding requirements had been very accurately calculated, the individual rations carefully compounded according to Kellner's tables, and their cost ascertained in each case.

In the second part of his work, the writer gives results from various pasture farms for 1909 and 1910. These results are given in ascending order of the number of head of stock carried per acre of pasture. It will be noticed that the number of head per acre has a marked influence on the gross yield of the pastures, as well as on the net yield and on the cost of production. The last farm, which in 1910 carried 1.6 head of cattle per acre, seems to have been overstocked. The gross yield was no higher, the net yield was lower, and the cost of production went up.

TABLE III. — *Results from Pasture Farms in 1909-1910.*

Head of cattle carried per acre		Gross return per acre of pasture s.	Net return per acre of pasture s.	Cost of producing 1 lb. live weight d.	Net return per acre for the whole farm s.
1909 .	{ 0.30	38	7	6.7	— 11
	{ 0.72	86	66	2.7	+ 30
	{ 0.74	88	20	5.0	21
	{ 1.13	141	87	3.2	62
	{ 1.41	152	109	2.5	29
1910 .	{ 0.45	35	— 11	9.1	11
	{ 0.62	88	43	3.2	35
	{ 0.65	66	38	4.0	25
	{ 0.66	54	39	3.5	39
	{ 0.78	92	55	3.2	56
	{ 0.83	96	55	—	25
	{ 0.95	123	90	3.2	8
	{ 1.62	120	59	3.7	62

According to Strebel's calculations, the cost of rearing a 2-year-old bullock is about £26 and the cost of producing 100 lbs. live-weight is about 54s, in raising young stock.

The writer's investigations on the cost of production in fattening cattle produced the results given in Table IV.

TABLE IV. — *Cost of Production of Fattening Cattle.*

	I 1908-11 Average d	II 1908-11 Average d	III 1909-12 Average d	IV 1907-10 Average d	V 1906-11 Average d
Per head per day:					
General expenses	1.55	1.55	1.52	1.56	1.65
Labour	1.2	0.7	1.1	1.0	0.9
	s d	s d	s d	s d	s d
Purchasing	2 8	2 5	1 5	2 10	2 6
Total outlay	4 0	3 7	2 7	4 11	3 11
Feeding	1 1	1 1	1 0	1 11	1 3
Cost of production per 100 lbs. live-weight	35 7	32 10	40 4	47 6	40 4

The great influence of the cost of feeding and of the difference between cost-price and sale-price in rendering the fattening of cattle profitable or unprofitable should be noted.

Finally, the writer gives the results of Howard and Lehmann's researches on the cost of fattening pigs. The average cost of production varies from 37s 6d to 40s 6d per 100 lbs. live-weight.

668—**The German Imperial Commission of 1912-13 on the Cattle and Meat Trades.**—
1. *Verhandlungen der Gesamtkommission und Zusammenstellung der Sachverständigen Gutachten*, XVI + 468 pp. — 2. *Anlagenband I: Sachverständigen-Vernehmungen*, XII + 99 + 107 + 131 + 103 + 80 pp. — 3. *Anlagenband II: Materialien*, IV + 376 pp. + 11 tables. Berlin, 1913.

In 1912 the German Government set up a Commission of 30 members for the purpose of enquiring into the condition of the cattle and meat trade. The Commission held a preliminary sitting on the 22nd of November 1912, to discuss the scope of the enquiry, and subsequently, up to the 20th of October 1913, sat on five occasions, each sitting occupying two days, to consider the evidence of 165 experts, including representatives of farmers, cattle-dealers, butchers, cattle valuation societies, and various towns in all parts of Germany. Representatives of the Imperial Government and of the Governments of the different Federated States also took part in the discussions.

The following questions in particular were considered at the various sittings: the determination of the price paid for beasts sold to the butcher; the question of dealers; the slaughter of immature calves; credit in relation to the cattle-trade; dealers' and slaughterers' commissions; the meat trade; meat-selling by stores, shops, and industrial enterprises; long-term contracts; experience with foreign meat, and municipal meat-buying; boards for fixing the price of meat; estimation of prices; organization of information and statistics.

The entire proceedings of the Commission, including the evidence of the experts and the material furnished by the investigations, were collected at the Imperial Ministry of the Interior and published in the three volumes under notice.

We here give only a few results of enquiries made by the Sub-Commission on the relative price of fat stock on the farm and in the market. After some endeavours to make a direct enquiry as to farm prices by general investigation in the country districts, the Sub-Commission soon came to the conclusion that the only way to obtain an accurate idea of the difference between the price on the farm and that in the market was to ascertain from a series of fat stock markets the sale prices of a large number of beasts in the country and the expenses entailed by them between then and their sale in the market. On these lines, therefore, thorough enquiries were made at the markets in Berlin, Dresden, Breslau, Hamburg, Munich, Frankfurt-on-Main, Mannheim and Cologne. The whole of the material collected was then arranged in such a way that for each individual purchase the following particulars were ascertained:

1. The price in the country, *i. e.* the sum paid to the farmer.

TABLE I.
Sundry expenses (in marks per head), for cattle sold by dealers.

I Markets	II Transport	III Gratuities	IV Insurance	V Commission on sales	VI Expenses of marketing	VII Total expenses of marketing IV-VI	VIII Total expenses of sale II-VI	IX Loss in weight	X Total expenses VIII + IX
<i>1. Bulls and Steers:</i>									
Berlin.	11.12	1.11	7.05	6.40	6.42	19.86	31.98	15.85	47.70
Dresden (1)	11.62	1.50	7.73	11.87	6.82	26.42	38.44	13.47	52.57
Breslau	6.95	1.95	5.04	5.48	4.02	13.63	21.38	—	—
Hamburg	8.21	0.30	4.08	9.62	3.07	16.81	25.00	17.44	42.81
Munich (1)	7.24	1.00	4.32	2.77	2.54	9.36	16.96	—	—
Frankfort (1)	7.32	1.67	—	6.35	1.83	4.55	12.76	—	—
Mannheim (1)	5.37	2.50	—	6.26	2.81	8.58	14.91	—	—
Cologne (1)	5.65	2.50	3.00	—	1.76	4.35	10.01	—	—
<i>2. Cows:</i>									
Berlin.	11.53	1.83	8.75	7.27	5.25	21.27	33.92	14.30	49.35
Breslau	6.99	1.50	6.00	4.33	4.11	13.44	21.93	—	—
Hamburg	8.46	—	8.04	8.68	2.93	21.01	29.47	—	—
<i>3. Calves and Sheep:</i>									
Berlin	2.85	0.50	0.75	1.88	1.41	3.47	6.65	2.26	6.04
Dresden	1.83	0.50	0.20	1.45	2.03	3.68	5.75	1.14	6.89
Breslau	0.76	0.50	0.50	0.54	0.70	1.74	3.00	—	—
Hamburg	1.00	—	0.10	1.20	0.70	2.00	3.00	—	—
Munich	2.09	—	—	1.22	0.75	1.97	4.06	—	—
Cologne	3.57	—	—	1.30	2.00	3.30	6.87	—	—
<i>4. Pigs:</i>									
Berlin	3.65	—	1.00	1.98	2.10	5.08	8.73	6.98	15.70
Dresden	2.19	—	0.80	1.92	2.48	5.20	7.39	6.93	13.92
Breslau	1.47	0.75	1.00	1.38	2.25	4.63	6.85	—	—
Munich	2.50	—	—	0.55	0.65	1.20	4.50	—	—
Frankfort	—	—	—	1.10	1.25	2.35	3.00	—	—
Mannheim	2.52	—	0.80	1.43	1.15	2.27	4.78	—	—
Cologne	2.59	0.30	0.60	1.73	2.51	4.41	7.07	—	—

(1) Cattle in general.

TABLE II.

Sundry expenses (in marks per head) for cattle sold by co-operative societies.

	I	II	III	IV	V	VI	VII	VIII	IX
	Transport	Expenses of the Co-op. Society and of insurance during transit	Insurance	Commission	Market expenses	Total market expenses IV-VI	Total expenses of the sale II-VI	Loss in weight	Total expenses VIII + IX
<i>1. Cattle:</i>									
Berlin	10.70	2.91	7.09	7.56	4.88	19.53	31.78	—	—
Hamburg	7.32	1.50	4.09	8.93	3.83	16.68	22.38	—	—
Munich	3.13	0.50	3.38	3.58	3.47	10.43	12.87	—	—
Frankfort	—	1.42	—	6.00	8.50	14.50	15.92	—	—
Mannheim	8.45	1.50	5.00	6.04	3.63	14.68	24.13	—	—
Cologne	1.78	—	3.00	4.39	4.68	11.32	2.30	—	—
<i>2. Calves:</i>									
Berlin	1.74	1.98	0.70	1.48	1.40	3.58	7.30	—	—
Dresden	1.81	1.63	0.20	1.58	1.40	3.18	6.62	—	—
Hamburg	1.16	0.28	0.30	2.45	1.12	3.87	4.27	—	—
Munich	1.01	0.46	0.20	1.07	0.77	2.03	3.34	—	—
Frankfort	—	—	—	1.40	1.45	2.85	2.85	—	—
Mannheim	2.80	1.00	1.00	1.52	0.37	2.89	6.69	—	—
Cologne	—	—	—	1.30	1.95	3.25	—	—	—
<i>3. Pigs:</i>									
Berlin	2.99	1.57	1.00	2.35	1.82	5.17	9.33	—	—
Dresden	3.90	1.42	0.80	2.59	2.75	6.14	11.46	—	—
Hamburg	0.95	0.36	0.60	1.25	0.65	2.50	3.06	—	—
Munich	1.82	0.78	0.31	0.85	0.69	1.84	3.05	—	—
Frankfort	—	0.40	1.00	2.28	1.03	3.41	3.79	—	—
Mannheim	1.85	1.00	1.00	1.81	0.81	3.62	6.00	—	—
Cologne	—	—	0.60	1.37	2.03	3.37	—	—	—

2. The price in the market, *i. e.* the sum paid by the purchasing butcher.

3. The incidental expenses of the deal.

4. The gain or loss to the dealer.

From these it was discovered that a large majority of the transactions enquired into, at the markets mentioned, resulted in a loss to the dealer by reason of a fall in the price of fat stock. The average sale-price per 100 kg. (220 lbs.) live-weight for cattle (bulls, steers, cows and heifers) did not

usually exceed the purchase price in the country by more than about 5 to 7 marks (1), while in the case of smaller stock (especially pigs) this excess in some cases reached as much as 40 marks. The purchase-price of cattle per 100 kg. generally varied between 90 and 100 marks (45s to 50s per cwt.) and the sale price between 95 and 110 marks (47s to 54s 9d per cwt.). The purchase price of calves and pigs was mostly near 120 marks per 100 kg. (60s per cwt.) and the sale-price averaged about 140 marks (70s per cwt.) but here and there rose above 160 marks (80s per cwt). The incidental expenses may be seen from Tables I and II.

It was further found that the price on the farm is governed by the price in the market, and not vice versa, and that consequently the farm price may be reckoned by deducting the incidental expenses from the market price.

If this method of calculation does not always lead to exact results, the explanation is to be sought in the great distance often intervening between the purchase in the country and the sale in the fat-stock market, and in the fact that the irregular supply at the markets exercises a great influence on the prices. It has hitherto been impossible to regulate the supply to the markets, and thereby to eliminate its price-raising influence. If the prices have been sent down by a glut on any market, the farmers refuse, on the score of the low prices, to sell their stock to the dealers. The result is that the next markets are only feebly supplied and the prices go up again. Thus great oscillations are observable in the price of fat stock, and these exercise an unfavourable influence on the cattle-trade in general. This unfavourable influence on prices is not exercised by cooperative selling at the fat-stock markets, because in this case the fluctuations of the market recoil immediately upon the producer, who thus makes a smaller profit and cannot afterwards seek to recoup his direct losses, as the dealer does, from the next market.

669 - **Book-keeping Competition for Small and Medium-sized Farms in East Prussia.** — *Georgine*, Year VII, No. 40, Königsberg, May 16, 1914.

The East Prussian Chamber of Agriculture has organised its third book-keeping competition for holders of small and medium-sized farms. Competitors are limited to holders of not more than 100 hectares (247 acres), who either keep the books themselves or entrust them to a member of their household. The accounts must cover a whole year's operations and must include:

1. A cash account, *i. e.* a record of all incomings and outgoings, household and farm expenses being kept as distinct as possible.
2. A household account with a careful record of all goods furnished by the farm.
3. An inventory containing a valuation of buildings, and live and dead stock at the beginning and at the end of the period under consideration.
4. A balance sheet.

(1) The Mark is about 11 3/4d, or 23.86 cents.

The total value of the prizes amounts to 500 marks (£ 25). They will be awarded by a special committee made up of members of the Council of Rural Economics and Book-keeping of the Chamber of Agriculture. All data or figures communicated by competitors will be treated as strictly confidential.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

670 - Results obtained by the Distribution of Pure Hungarian Yeast Cultures in 1912. — REQUINYI, G. in *A. m. Kir. Ampelologiai Intézet Évkönyve* (Yearbook of the Royal Hungarian Ampelological Institute), Vol. V. pp. 36-39. Budapest, 1914.

One of the most important functions of the zymological section of the Royal Hungarian Ampelological Institute consists in collecting yeasts from the best wine-producing districts of Hungary, for the use of the vine-growers in wine making. This work was begun in 1901; the yeasts were taken from the lees of young wines and from the sediments of old wines (1). By 1906 it was possible to commence the selection of primary cultures, that is to say the founding of pure cultures of each kind, starting in every instance by inoculation with a single cell. This was a tedious process, having regard to the enormous number of species which exist (2), and more particularly because it was always essential to regard the matter from the practical standpoint, and to endeavour to obtain species which might exhibit qualities of value for wine making. The aim in studying individual species was to determine:

1. How far yeasts will ferment must of normal composition under conditions of varying temperature (24° to 25° and 6° to 12° C.), and must containing 35 per cent. of sugar.

2. Their power of resisting sulphur.

3. Their vitality, strength and power of forming sediment.

In fact, all the morphological and physiological characteristics which may serve toward the exact classification of the species. The number of primary cultures obtained from the material collected was 976. The study of these cultures produced 73 species, and after subsequent reduction, and elimination of species of no marked value, 54 species were successfully defined and are preserved in a dilute solution of saccharose, representing the Ampelological Institute's "Collection of Species"; although all the species ferment must of normal composition, each one presents specific characteristics and advantages, suitable for use under special conditions, e. g. the production of sweet wines, champagne, membranous growth, etc.

(1) It is important that the yeasts should be collected from the lees, as this ensures obtaining those which have produced the fermentation of the wine, while those found in the wine itself are the yeasts which take part in the after-fermentation.

(2) From 1901 onwards, 341 divisions have been made, producing 73 species, from 20 yeasts collected in the Tokaj district (*Bulletin of the Royal Hungarian Ampelological Institute*, No. 1, p. 56. 1908).

After being carried through the experimental stage, the pure cultures were offered to vine-growers; 24 vine-growers asked for samples of yeasts in 1911, and this number increased to 152 in 1912 and 230 in 1913. The growers were supplied with application forms in which they stated certain working details, and the yeasts best corresponding to the growers' demands were sent to them, soaked on to cotton-wool, together with printed instructions for the use of the yeasts.

The following were the results of the experiments made in this way by vine-growers in 1912 (1):

1. In 65.6 per cent. of the fermentations carried out by the producers, the inoculation of the must was a complete success. The fermentation, clarification, and maturing of the musts treated in this way were effected more speedily and, in the majority of cases, the appreciation in value was estimated at an average of from 5 to 7 crowns a hectolitre (2 *d* to 3 *d* per gall.).

2. In 21.9 per cent. of the cases, the flavour of the wines showed no markedly increased development, but by reason of the quicker and purer fermentation, this development was also more speedy, and the draining-off easier.

3. In 12.5 per cent. of the cases only, no difference was noted between the produce of the inoculated must and that of the control.

Finally, the fact should be emphasized that in no case was an adverse result reported.

The smaller growers worked with from 1 to 20 hl. (22 to 440 galls.) of must, while the others carried out their experiments with 50 to 300 hl. (1 000 to 6 500 galls.) The total quantity of must inoculated during the 1912 experiments may be reckoned at 2300 hectolitres (50 600 galls.).

671 - **Hybrid Wines at the Toulouse Exhibition, 1914.** — PÉRE-LABY in *La Vie Agricole et Rurale*, Year 3, No. 21, pp. 581-585. Paris, April 25, 1914.

Exhibitions of wines from direct-bearer hybrid vines have been held for some time now at Toulouse. Of the 60 white wines exhibited in 1914, the following proved the best: Cirere No. 157; Seibel Nos. 880, 4151, 3013 (liable to mildew), 2563, 3021, 2663. Seibel Nos. 2859 and 2677 produced fairly good rose wines. All the varieties mentioned above are entirely free from oidium (powdery mildew). Among the Malègue hybrids, the following were classed as "good": 469-2, 1157-1, 1063-7, 1647-8, 1879-12, 2064-6, 2094-3, 2328-1 and 2401-4; their resistance to mildew (*Plasmopara*) and oidium is not yet sufficiently ascertained.

The quality of the wines exhibited in 1914 was on the whole better than in 1913. The writer comes to the conclusion that, at a comparatively small cost, white wines could be produced from the above hybrids, which might be consumed alone or blended with other wines or with each other. Many of them could quite well compete with the ordinary French white

(1) The results for the 1913 trials cannot yet be published, as the necessary data, the testing of the wines, etc., are not yet complete.

wines, and some, according to the verdict of the judges at the show, even with the better types.

Of the 120 red wines exhibited, the following deserve special mention : as general blending wines, the less delicate wines among the Seibel hybrids are noteworthy, namely 128, 156, 1020, 1077, 2003, 2007. The following newer hybrids produced quite good, but perhaps rather less full coloured wines : Seibel Nos. 1007, 2052 and 877, Couderc 4401, Le Madone and Couderc 286-68. The following wines were of a very fine red colour, with a good aroma, a delicious flavour, and plenty of fire : Malègue 2219-6, 2054-7, 2161-2, 2359, 1539-22, 2271-1, 2055-15, 1583-21, 391-6, 829-6, 2046-8 and 469-9. For the four last-named, two sprayings form a sufficient protection against mildew, while the others have not yet been sufficiently tested. The following wines, with a normal red colour, are also worth mentioning : Seibel Nos. 1000, 60, 4004, 3011, Bertylle-Seyve 413, Baco 1, Chenivessé 1-11. The exhibition of red wines shews : 1) that excellent blending wines can be obtained from red hybrids ; 2) that many red wines, of normal colour, can be used for consumption just as they are. The hybrid blending wines are also very useful for improving the colour of poorly-coloured French wines grown from European vines, or for improving local wines by adding more body to them, on account of their higher content of alcohol and dry-extract. Some of the red wines could even compete, according to the show judges, with some of the better kinds of European wine.

A special section of the Exhibition was devoted to purely blending-wines, and the fact was observed that certain of the hybrid wines, which were unfit for use by themselves, gave quite good results when mixed with other better wines, or even with wines of no great worth in themselves. Some mixtures of good wines far surpassed either of the component wines taken individually. This group of blending wines gave rise to the following observations : to improve red hybrid wines no French white wines of European vintage are needed, because the white hybrid wines, which cost much less, answer the purpose perfectly. For this reason, according to the writer, every vine grower who only grows hybrids ought to cultivate, along with his red kinds, enough white hybrid wines to enable him to improve the quality of his red wines and give them a higher market value. The mixing of certain red wines with one another produces in many cases also a good article, as was proved by various wines at the show. The greater the number of kinds of wine mixed (and this applies to red wines alone as well as to mixed red and white), the better the result tastes. Hybrid wines with a "foxy" or "grassy" taste (wines that come from hybrids of *Lincecumii*), should be mixed with hybrid wines which will mask this flavour, while wines having merely a raspberry flavour can, if required, be used alone.

672 - **Influence of Chloroform and of Oil of Mustard on the Aleoholic Fermentation of Grape-Must.** — KLOSS, in *Zeitschrift für Gärungsphysiologie*, Vol. IV, Part 3, pp. 185-193. Berlin, April 1914.

In order to preserve a sample of unfermented must for the purpose of submitting it subsequently to chemical analysis, chloroform or oil of mustard is sometimes added.

As a result of experiments on the action of these substances on ferments and on the fermentation of grape-must, the writer found that by adding 1 cc. of chloroform to 500 cc. of must, sterilized and inoculated with pure cultures of yeasts, the fermentation was arrested, but the multiplication of the yeasts was not entirely checked. Must inoculated with pure cultures of yeast 12 days old only fermented slightly and for a short time. With 6-day-old pure cultures the must did not ferment at all. This yeast thus showed itself less resistant than the older culture. At the end of the experiment the youngest yeast cells had for the most part died out, while those of the 12-day-old yeast, though deprived of glycogen, survived for the most part, and, when introduced into ordinary non-sterilized must, fermented it, which was not the case with the former cells.

Oil of mustard has a much more vigorous action, seeing that even 3 drops in 500 cc. of must checked not only the fermentation, but also the reproduction of the yeast. All the yeast cells were dead at the end of the experiment.

A second series of experiments was undertaken with non-sterilized must in various stages (fresh-pressed, slightly fermented and highly fermented). In this case also, oil of mustard was the more effective, 10 drops in a litre of must being enough to arrest the fermentation completely, a result which was not achieved even on adding 2 cc. of chloroform. The addition of chloroform seems to have checked the multiplication of this yeast more in this experiment than in the preceding.

A further experiment proved that the development of *Penicillium* was arrested by 5 cc. of chloroform or by 14 drops of oil of mustard per litre of must.

673 - **Co-operative Distilleries in the Pays de Caux, France.** — BERTHAULT, PIERRE, in *Comptes-Rendus de l'Assemblée Générale de 1914 de la Société des Agriculteurs de France*, pp. 653-656. Paris, May 15, 1914.

In the Pays de Caux, where the soil is remarkable for its fertility and carries wheat and sugar-beets well, the small size of the holdings places a considerable difficulty in the path of establishing industries requiring a large outlay of capital on the part of agriculturists.

It is due to the activity of the Director of Agriculture for the Seine Inférieure that co-operative distilleries have been formed. Of these there are at present four, situated at Raffetot, Anneville-sur-Scie, Fauville and Yvetot, all definitely co-operative in character. The distillery at Raffetot, which has the fewest members, comprises 16 producers and works 310 acres of beets. All these establishments employ exclusively the sugar-beets grown by their members. The latter, on the other hand, undertake to deliver to the distillery under the best possible conditions

all the sugar-beets they grow, and to put every year to beets a minimum area determined for each farm. The capital amounts to £2 660 at Raffetot, £3 560 at Anneville, £3 000 at Yvetot, and £3 200 at Fauville, each divided into £2 or £4 shares. The balance of funds required is advanced by the State, through the district Treasury of Upper Normandy, in the shape of a loan, as laid down by the Act of 29 December 1906.

The seed for the beet crops is distributed to members by the distillery, and deducted from their share of the profits at the annual settlement of accounts. The roots, when pulled, are sent to the factory, weighed and tared under the usual regulations, and the pulp is returned to the owners, in proportion to the weight of roots supplied. This pulp is taken back at half a crown per ton.

The administration of the Society is in the hands of a Board made up of at least 10 of the members, which superintends and controls all the commercial undertakings of the Society. At the end of each season, it divides the proceeds from the sale of the alcohol among the members, in proportion to the quantity and sugar-content of the beets contributed by each of them. Two deductions are first made to cover the repayment of the capital and the State loans.

The plant is, for the most part, on the Wauquier diffusion system, made to deal with from 60 to 70 tons of roots a day, at 6 degrees density, producing a very strong phlegm (92 at the least). The Anneville distillery is the only one fitted with Egrot machinery.

At the end of the first season at Yvetot, each member received an average of £41 10s per acre or £1 6s 5d per ton of beets.

674 - **Potato-drying Works in the German Empire in 1908-09, 1909-10, 1910-11.** — *Vierteljahrshefte zur Statistik des Deutschen Reiches, Ergänzungsheft zu 1913, III: Die Ergebnisse der deutschen Produktionserhebungen*, p. 76. Berlin, 1913.

In the following statistics the year commences on August 1 and ends on July 31.

During the three years 1908 to 1911 the potato-drying works in activity were respectively 170, 254 and 327. Of these 114, 167 and 216 were attached to farms or other agricultural undertakings; 40, 65 and 94 were cooperative concerns (among which those having the form of joint stock and limited liability companies and the like are included); 7, 9 and 7 were independent undertakings and 9, 13 and 10 were attached to independent industrial concerns.

In the 170, 254 and 327 works, 170, 254 and 331 drying plants were at work. Among these, 140, 208 and 270 were cylinders; 22, 36 and 54 were drums; 7, 9 and 6 were of the hurdle type and 1 was a press. As source of heat, 143, 209 and 273 used steam and 27, 45 and 58 the products of combustion. Some of the works, namely 82 in 1908-09, 143 in 1909-10 and 181 in 1910-11, worked with day and night shifts of 12 hours each.

The following table gives further details concerning the works and their produce.

	1908-09	1909-10	1910-11
Total number of works	170	254	327
Number of works that use peeled potatoes :	6	8	4
Of the above, strips and slices are made in.	3	5	1
» flakes » »	3	2	2
» flakes and meal » »	—	—	1
» strips, slices and meal »	—	1	—
Number of works that use unpeeled potatoes :	164	246	323
Of the above, strips and slices are made in.	25	39	52
» flakes » »	133	197	260
» crumbs » »	2	2	2
» flakes and meal » »	3	5	3
» flakes and crumbs » »	1	1	1
» flakes and strips » »	—	—	1
» strips and meal » »	—	—	4
» strips and groats » »	—	1	—
» strips, slices and groats »	—	1	—
	tons	tons	tons
Total quantity of potatoes treated	157 483	327 053	410 624
For the works themselves	147 200	286 735	369 003
Potatoes produced by the works	97 775	184 320	267 227
» from other sources	49 424	102 415	102 268
» produced in the country	48 795	99 725	99 384
» » abroad	629	2 690	2 884
For outsiders	10 643	40 318	41 621
Total amount of dried product per annum	40 875	86 119	105 507
For the works themselves, total	38 024	75 478	94 780
Strips and slices	5 243	11 512	10 340
Flakes	31 154	62 267	83 112
Meal	1 484	1 438	1 028
Crumbs, and other products	143	262	294
For outsiders	2 851	10 640	10 732
Strips and slices	1 115	4 168	3 872
Flakes	1 736	6 378	—
Flakes and meal	—	—	6 860
Other products	—	94	—
Sale of products made by the works for themselves	38 874	71 431	95 755
To themselves	10 069	17 889	21 308
Strips and slices	1 805	3 916	4 982
Flakes	8 176	13 852	16 131
Meal	—	—	61
Crumbs and other products	87.5	115	135
To others, in the country	27 363	52 072	73 958
Strips and slices	3 366	5 637	5 847
Flakes	—	—	67 118
Flakes and meal	23 942	46 333	—
Meal and crumbs	—	—	943
Crumbs and other products	55	107	—
To others, abroad	1 441	1 465	488

- 675 - **The Value and Use of Millet Malt.** — HÉRICs-TóTH, J. VON and OSZTRÓVSZKY, A. VON (Royal Hungarian Distillery Experiment Station, Gödöllő) in *Kísérleti Közlönyek*, Vol. XVII., No. 1, pp. 35-44 + 2 plates. (Summary in German, p. 45). Budapest, January-February 1914.

Millet malt has the same value as barley malt. In malting the only difference is in the steeping: millet may stay in the vat until it has absorbed its full amount of moisture by alternate steepings and exposures to the air, or it may afterwards take up the moisture still required by being sprinkled. In the first case the grain is steeped for 5 to 7 days; during the process it increases in weight by 35 to 50 per cent.

The disadvantages of millet are its extraordinarily high content of dirt, grass seeds and grains that do not germinate; also it is frequently covered with smut (*Ustilago destruens*). It is advisable to clean it before washing it. The really floating grains are not easy to recognize.

In order to prevent the formation of mildew, the steeped grain is daily ventilated once or twice. The temperature in the sweating heap should keep below 30° C. (86° F.). The best temperature for malting is from 18° to 23° C. (64° to 73° F.). Lower temperatures lengthen the operation without other inconvenience. The sprouting grain is heaped at first to a depth of 8 to 12 inches and gradually reduced to 4 in. It is advantageous to wash the malt when ready.

In comparison with other grains, the production of the necessary enzymes takes place with loss of matter. The saccharification and liquefying capacity, according to Effront and Lintner, are smaller than in barley and rye malt, but greater than in maize or oat malt. In brewing, millet malt has some very valuable properties: it prevents frothy fermentation; the ratio between the maltose and dextrin formed, the final fermentation and the production of alcohol are good. Probably in the various grains the structure of the saccharification enzymes is the same, and the cause of the lower Effront and Lintner values does not lie so much in the greater or lesser capacity of producing enzymes as in the want of an agent (co-enzym, enzym, etc.) to increase the diastatic power of the various kinds of malt over pure and soluble starch. This agent is, however, contained in sufficient quantity in the various raw materials used in the mashes. With the analytical method, according to which less malt is taken than is required for the saccharification of the mash, the differences in the malts become apparent. The curve of the formation of diastase in millet resembles that of maize; after attaining the highest value of diastatic power it sinks rapidly.

- 676 - **The Influence of the Fat Content of Milk upon the Rapidity of Coagulation.** — KREIDL, ALOIS and LENK, EMIL in *Biochemische Zeitschrift*, Vol. 63, Parts 2 and 3, pp. 151-155. Berlin, May 28, 1914.

In estimating the coagulating power of rennet, it is generally accepted as a law that the quantity of ferment used multiplied by the time required to obtain coagulation is a constant. This law is, however, modified by numerous factors, such as temperature, neutral salts, lime-precipitating bodies, alkaloids and more especially by the previous treatment of the

milk. The writers have shown that the rapidity of coagulation of a sterilized milk could be so diminished that often after 24 hours no coagulation had yet taken place. When, however, a non-sterile rennet or an incompletely sterilized milk was used, coagulation immediately set in. The writers observed also that when previously treated milks containing different amounts of fat received the same quantities of rennet, coagulation did not set in at the same time.

These experiments were recently repeated by the writers with five different milks containing respectively 1, 3, 10, 16 and 30 per cent. of fat. The milks were placed in test tubes kept at 40° C. (104° F.) in a water-bath. A fresh 1 per cent. neutral filtered solution of Grüber's rennet was used. Every five minutes the test tubes were taken out and examined for changes in the milk; all five were examined at the same time.

In the first experiment, in which 1 cc. of rennet solution was added to 10 cc. of each of the undiluted milks, no difference in the rapidity of coagulation was observed. In the next experiment, in which each of the milks was diluted with 50 per cent. of water, it was found that the lower the fat content of the milk, the more rapid and complete was the process of coagulation.

677 - **Purification and Disposal of Waste Water from Dairies.** — DORNIC, DAIER and VIGNEROT, in *Annales de la Science Agronomique*, Year 31, No. 4, pp. 150-170. Paris, April 1914.

The waste water from dairies cannot be allowed to flow into streams, rivers or the subsoil without first being purified. In France, the Act of 1902 imposes on local authorities the obligation to make bye-laws dealing with the question in their districts. Another Act, at present in course of preparation, is to deal with drainage into non-navigable rivers.

The process of purification employed varies naturally with the composition of the waste water, which in its turn depends on the type of work carried on in the dairy. From this point of view dairies may be divided, into four classes:

1. Dairies which receive milk from farms and forward it on to towns, with or without pasteurizing. These dairies produce a volume of waste water equal to half the milk dealt with, and proceeding chiefly from the washing of cans, machinery and receiving platforms.

2. Dairies where the milk is used for making cream, butter and cheese, but where the whey is returned to the farmers, after the casein has been extracted. Such dairies use a volume of water about equal to the amount of milk dealt with.

3. Dairies where pig-fattening is practised. These have to dispose of a volume of water about 2 to 2½ times that of their milk.

4. Dairies which extract the casein from the whey and discard the casein with the waste water. In these the outflow of water is double the volume of milk dealt with. This class is tending to disappear, as being economically unsound, seeing that pig-rearing pays 2d to 2½d per 10 galls. for whey with the casein removed, which is wasted in dairies.

of this class. Besides, the waste water from them can only be purified by a biological process, which is exceedingly long and troublesome.

The composition of the waste water from a given dairy varies with the circumstances and the individual dairies. The range of possible variations is given in Table I.

TABLE I. — *Composition of waste water in mgm. per litre.*

	Water in which milk-cans have been washed (Kattein and Schoofs)	Bömmmer	Calmette	Daire (water from butter factories)
Capacity for oxidation in mgm. of potassium permanganate per litre	754.7	126 to 4076.4	—	550 to 3050
Organic nitrogen	24.5	7 to 118	43.6 to 115	15 to 130
Organic substances	300.7	253 to 2733	1550 to 2135	215 to 1763
Fatty substances	from 159 to 290	—	628 to 1440	80 to 739
Milk-sugar	—	traces to 731	—	traces to 0.509

The waste water decomposes quickly, especially in summer, and gives off a foul smell due to the putrefaction of the casein and the albuminous matter. The milk-sugar is not present in a large enough quantity to be harmful, and besides, the acid fermentation which it undergoes would rather tend to delay proteolytic fermentation. Fatty matter decomposes very slowly. The chief object to aim at, therefore, is the reduction of the casein, and as this substance decomposes fairly rapidly, prompt action is required.

There are three different kinds of processes of purification: chemical processes, biological processes, and the filter-bed method. The last is the most suitable in the majority of cases. A chemical process recently invented by Daire seems to have a great future before it, and is described below in detail.

Chemical processes.—Considerable reduction of the nitrogenous matter in the waste water from cheese factories has been obtained with the use of the following substances (Table II):

TABLE II. — *Reduction by chemical means of the nitrogenous matter in the waste water from dairies.*

Reagents	Percentage of nitrogenous matter removed
Aluminium sulphate + lime	69.6
Perchloride of iron + lime	67.5
Ferrous sulphate + lime	25.8
Ferric sulphate + aluminium sulphate + lime . .	67.5
	75.3

Reduction in bacterial content was also obtained by adding 2.3 gm. of ferric sulphate per litre to water containing organic matter, but this process, in addition to being more expensive than the foregoing, gives a residuum which cannot be turned to account.

Hamilton's method, though extremely ingenious, unfortunately scarcely admits of application to commercial use. It is carried out by means of two masonry reservoirs. In the first of these the water is heated for 24 hours by means of a coil; a part of the albuminoids is precipitated by lactic, butyric and acetic fermentations. In the second, thick lime wash and sodium silicate is added; calcium silicate is formed, and carries off the albuminous matter in solution. The precipitate may be used as a manure, and the clean water can be drained into a river.

Daire's new chemical process, in use at the co-operative dairy at Courçon d'Aunis (Charente Inférieure) requires the following plant: *a*) a cylindrical decanting-basin, of about 350 cu. ft. content, in which decantation is effected by a system of outlet pipes flush with the level of the deposits inside the basin; *b*) a filter basin made of reinforced concrete, 6 ft. across and 31 in. deep, containing a bed of coarse slag, covered over with a layer of turf; and *c*) various accessories (a cement gutter, a pump and chute for waste water, a stirrer, etc.); the whole costing about £80.

The process is as follows: First, calcium superphosphate (6 $\frac{1}{2}$ lbs. per 100 cu. ft. of water to be treated), is spread over the bottom of the basin; then the waste water is forced into the basin as fast as it is produced. When it is all in, milk of lime (which must not contain carbonate) is thrown into the basin, in just sufficient quantity to neutralize the phosphoric acid. In practice, it can be seen when this quantity has been reached by the liquid in the basin turning pink. An excess must not be given or albuminous matter will be dissolved. During the operation, stirring takes place by means of a stirrer consisting of a perforated iron disc on a long handle. When the mixing is complete, it is allowed to remain for 3 hours at least, after which the clear liquid is decanted and the deposit sent to the filter basin. It is convenient to arrange for the filtration to take place at night. The operation must be performed once in 24 hours.

This process, which has given complete satisfaction for a year at Courçon d'Aunis, is cheap, requires only a small amount of labour and makes use of easily obtained and inexpensive materials (superphosphate, lime and turf). The turf manure taken from the filter basin undergoes very active nitrification owing to the presence of the lime, and exhibits the composition shewn in Table III.

TABLE III.

Composition of turf manure from filter basins (average of 14 analyses).

Water	80.2 %
Organic nitrogen.	0.38 »
Inorganic »	0.27 »
Mineral substances	5.85 »
Phosphoric acid (P_2O_5).	0.77 »

It will be noticed that this manure contains as much nitrogen and phosphoric acid as farmyard manure. Its value is therefore considerable, and in fact easily repays the cost of setting up the plant.

Biological processes.—Anaerobic fermentation in septic pits is suitable for dairies of the first three classes. For water rich in serum, the plant is complicated and costly, in addition to which the standard of intelligence obtaining among persons engaged in the dairy trade makes the method somewhat inapplicable. Oxidation in bacteria beds may be continuous or intermittent, the former being the more perfect. Water rich in serum requires previous neutralization and a more complex plant. Purification by irrigating growing crops is the most economical method and is the right one to employ wherever there is a large enough area and a sufficiently porous soil. Stagnation must be avoided, and too much water must not be allowed to soak into highly porous soil, for fear of polluting the underground water supply. Suitable crops for receiving such irrigation are forage crops, osier beds and vegetables.

678 — **The Activity of Cooperative Dairies in Hungary in 1911-12.** — Extract of Report in the Statistical Yearbook on the activity of the Hungarian Government in 1912, in *Volkswirtschaftliche Mitteilungen aus Ungarn*, Year IX, No. 2, pp. 194-196. Budapest, February 1914.

At the end of 1912, 528 cooperative dairies were working, or 26 less than at the end of 1911. Of these

335	or	63	per cent.	were founded in	1896-1905
121	»	23	»	»	» in 1906-1910
40	»	8	»	»	» 1911
20	»	4	»	»	» 1912
12	»	2	»	»	» before 1896

Comparative data for the years 1911 and 1912 are given in the adjoining table.

	1911	1912
No. of members	57 436	55 777
No. of cows registered	97 658	91 515
Total amount of milk received . million galls. .	21.5	22.8
Av. annual yield per cow. galls. .	220	250
Produce sold :		
Whole milk million galls. .	6.92	9.25
Cream galls. .	255 000	300 000
Butter metric tons (1) .	2 100	2 400
Cheese » » .	1 869	2 103
Other produce » » .	10 200	1 700

During 1912, 57 of the dairies received Government grants amounting to £3086, fourteen received grants from local authorities and four received grants from other sources.

(1) 1 metric ton = 0.9842 long ton.

679 - **A Review of Beef Production in the United States.** — MUMFORD, H. W. and HALL, L. D. — *University of Illinois Agricultural Experiment Station, Circular, No. 169*, pp. 1-28. Urbana, Ill., September 1913.

Cattle fattening was first practised in the United States at the beginning of last century. Starting in the State of Ohio it gradually extended westward over Kentucky, Indiana and Illinois, while at the same time the grazing industry spread northward from Texas over the great western plains. Then in the second half of the century, after the Civil War, an increased demand for beef in the East together with improved facilities for cattle transport stimulated the production, and the industry gradually extended westward with the building of the railways and the introduction of the refrigerator car.

The cattle census per decade is given in Table I, together with the ratio of the cattle to the population.

TABLE I. — *Number of cattle per decade and ratio of cattle to population.*

Year	Total cattle	Cattle other than milch cows	Increase in total cattle, per cent.	Total cattle, per capita	Cattle other than milch cows, per capita
1870.	25 000 000	15 000 000	—	0.64	0.39
1880.	33 000 000	21 000 000	+ 32	0.66	0.42
1890.	53 000 000	37 000 000	+ 60	0.84	0.59
1900.	68 000 000	45 000 000	+ 28	0.89	0.66
1910.	62 000 000	41 000 000	— 10	0.67	0.45
1912.	58 000 000	37 000 000	— 7	—	—

The number of cattle increased up to 1900 and then decreased, but the decrease shown in 1910 is in reality less than would appear from the figures, as the census in that year was taken on April 15 instead of on June 1, which had been the customary date previously, and it is estimated that 5 to 6 million calves are born between those two dates. Even making allowance for this, the decrease is significant, especially when considered in relation to the increasing population. A natural consequence of the decline has been a diminution of the surplus available for export, as shown in Table II.

The numbers and percentages of the various classes of cattle in April 1910 are given in Table III together with the average value of the animals of the different classes.

Almost two-thirds of the cows of breeding age are designated as dairy cows, the remainder being kept mainly for raising beef calves, and the dairy cows are worth almost \$12 a head more than the beef cows. The ratio of bulls and steers to cows and heifers is 1 : 1.46.

TABLE II. — *Surplus of cattle available for export.*

Year	Value of all cattle other than milch cows	Value of exports of beef cattle and beef	
		Absolute	Relative
	\$	\$	per cent
1870	290 491 000	2 693 000	0.9
1880	341 761 000	31 544 000	9.2
1890	560 620 000	53 170 000	10.0
1900	689 486 000	68 407 000	9.9
1905	661 571 000	72 435 000	10.9
1908	845 938 000	55 466 000	6.6
1910	917 453 000	24 400 000	2.7
1912	790 064 000	14 602 000	1.8

TABLE III. — *Cattle classified by age and sex, 1910.*

	Number	Percentage	Av. value per head
			\$
Calves born after Jan. 1, 1910 (under 3 1/2 months)	7 806 539	12.6	6.66
Steers and bulls born in 1909 (3 1/2 to 15 1/2 months)	5 450 289	8.8	26.66
Steers and bulls born before 1909	7 598 258	12.3	
Heifers born in 1909 (3 1/2 to 15 1/2 months)	7 295 880	11.8	14.14
Cows and heifers not kept for milk, born before 1909	12 023 682	19.5	22.39
Cows and heifers kept for milk, born before 1909	20 625 432	33.4	34.24
Unclassified	1 003 786	1.6	20.95
Total	61 803 866	100	

The geographical distribution of the cattle other than milch cows in April, 1910 was as follows:

North Atlantic States	2 130 000
South "	3 029 000
North Central " west of the Mississippi	12 320 000
" " " east " "	4 990 000
Southern and Gulf "	10 786 000
Far Western "	7 925 000
Total	41 180 000

The North Central States and the region including Oklahoma and Texas contain the largest number of cattle, the so-called "corn belt" States -- Ohio, Indiana, Illinois, Iowa, Missouri, Nebraska and Kansas -- accounting for almost one-third of the total number. Moreover, as large numbers of cattle are yearly brought into the "corn belt" to fatten, it is estimated that half the total beef produced in the United States comes from that district. As two-thirds of the cattle are west of the Mississippi, while two-thirds of the population are east of the Mississippi, there is an enormous movement of fat cattle from west to east to supply the demand for beef in the more densely populated districts, and this movement has brought about the establishment of the great cattle markets at Chicago, St. Louis, Kansas City, etc. These large central markets slaughter about half the total cattle in the United States. In 1903 the distribution of slaughtered cattle was estimated as follows:

	Head
At large central markets	6 570 000
In other cities of over 50 000 inhabitants . . .	930 000
In cities and villages of under 50 000 inhabitants	3 500 000
On farms and ranges	1 500 000
Total . . .	12 500 000

Further, in that same year, 520 000 head were exported alive, bringing the total number marketed for slaughter up to 13 020 000 head, of which 5 500 000 head or 45 per cent. were killed by six companies known as the "big packers".

680 - Arrangements for the Carriage of Agricultural Produce by Rail in France, especially on the Paris-Lyon-Méditerranée Co.'s System. — BOUSIGUES, in *Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, Nos. 2 and 3, pp. 194-212 and 300-329. Paris, February and March 1914.

AGRICULTURAL
PRODUCTS:
PRESERVING,
PACKING,
TRANSPORT.
TRADE.

The writer deals with the chief arrangements made by all the French railways for improving the carriage of agricultural produce. He describes the ice stores and the perfection of the rolling-stock on the State railway, the lowering of tariffs for milk by the Est Co., the fitting of vans for mushrooms, beer, bananas, beets and pulp on the Nord, and the various arrangements made by the Paris-Lyon-Méditerranée to encourage the trade in fruit, early vegetables and flowers. The last-named will be dealt with here.

From the agricultural point of view, the P. L. M. system is particularly rich; the natural resources of the districts it serves ensure a heavy traffic at all seasons: cereals in Brie, Beauce, Limagne and Lower Burgundy; wines in Burgundy, Franche-Comté, Auvergne, Languedoc and Provence; store cattle in the Charolais and the Nivernais; early vegetables and olives in Provence; oranges and flowers on the Riviera; fruit and vegetables in parts of the valleys of the Saône, Rhône and Durance. The Company also deals with the produce from Algeria, Tunis and Morocco.

Table I shows the progressive increase in the food-products carried by slow goods trains.

TABLE I.
Carriage by slow goods trains on the P. L. M. (metric tons).

Goods	1912	1911	1910	Difference 1912-1910
Wine	2 629 000	2 366 000	2 655 000	— 26 000
Flour	1 023 000	1 085 000	964 000	+ 59 000
Cereals	2 335 000	1 727 000	1 525 000	+ 810 000
Fruit, vegetables, milk, etc.	950 000	955 000	921 000	+ 29 000
Hay, straw	677 000	568 000	543 000	+ 134 000

The P. L. M. Co. has made special efforts to increase the traffic in fruit, early vegetables and flowers by express train ; for this purpose trains have been speeded up and the best possible conditions arranged. Table II shows the amounts of these goods carried by express service.

Besides the ordinary post-trains, the Co. runs eight or ten special trains for perishable goods daily ; their average speed is 40 m. p. h., so that the run from Marseilles to Paris (536 miles) is done in 22 to 24 hours and that from Avignon to Paris (458 miles) in 18 to 20 hours ; these times include unavoidable stoppages as well as the collecting at the various departure stations.

In 1911 this organization was completed by special arrangements at Chasse, a Station 13 miles south of Lyons on the left bank of the Rhône.

Arrangements at Chasse station. — The station is on the Paris-Ventimiglia line, and is the junction for three branches: Lyons-Nîmes by the right bank of the Rhône ; Roanne-Lyons, via St. Etienne ; Paray-le-Monial-Givors. Goods can be sent to Paris and England by three routes: St. Etienne, Lozanne or Dijon ; to the Est Ry. via Dijon Is-sur-Tille ; to Germany via Bourg-Besançon - Belfort ; to Switzerland via Ambérieu-Geneva.

The vans passing through Chasse number 60 000 yearly ; the packages are rearranged so as to make up whole trains requiring no shunting other than the dividing up at junctions ; in this way 6000 vans are liberated. The Chasse station is informed by telegraph of the composition of the trains arriving, and has a practised staff who put right irregularities in packing and examine the labelling. The compensation for loss, delay and damage paid on the Paris markets, has been reduced to 156 000 fr., or 1.51 fr. (about 1s 3d) per ton.

The P. L. M. Co. has also arranged with the Nord and Est Cos. and the German State railways for through fast services ; these allow perishable goods to arrive in excellent condition on the markets in London, Berlin, Cologne, Frankfort-on-Main, etc. The times are as follows :

Avignon to London	37 hours
Avignon to Frankfort-on-Main	39 "
Avignon to Berlin (Anhalt sta.)	57 "

TABLE II.

Fruit and vegetables carried by express train on the P. L. M. (metric tons) (1).

	1912	1911	1910	Difference 1912-1910 %	
<i>Fruit.</i>					
Table grapes	37 562	32 597	34 394	+ 9	
Cherries	14 293	11 717	9 271	+ 54	
Strawberries	6 551	5 993	6 552	—	
Peaches	5 708	11 752	4 334	+ 32	
Apricots	4 802	2 113	2 509	+ 91	
Plums	4 255	2 195	2 731	+ 56	
Pears	3 886	4 518	3 079	+ 26	
Other fruit	12 568	9 631	9 844	+ 28	
Total fruit traffic . . .	89 625	80 516	72 714	+ 23	
<i>Principal destinations:</i>					
France.	Paris	29 500	30 300	29 400	+ 0.3
	Lyons	4 400	3 800	3 900	+ 13
	Saint Etienne	2 200	2 500	2 400	— 8
	Other companies	8 300	8 100	7 000	+ 19
Abroad	Germany	14 300	8 000	6 900	+ 107
	England	5 200	4 200	4 000	+ 30
	Switzerland	7 700	6 800	4 800	+ 60
	Other countries (Belgium, Austria, etc.)	400	400	900	— 56
Algerian contribution to traffic on the system:					
including grapes	9 500	7 200	7 900	+ 20	
	8 600	7 000	7 700	+ 12	
<i>Vegetables.</i>					
Cabbages	23 132	17 299	12 944	+ 79	
French beans	19 949	20 877	14 553	+ 31	
Salad	18 662	16 183	16 806	+ 11	
Artichokes	13 934	10 588	11 419	+ 22	
Tomatoes	13 363	15 012	13 639	— 2	
Melons	11 571	9 657	7 070	+ 64	
Asparagus	8 710	9 646	8 331	+ 5	
Green peas	6 127	5 205	7 575	— 19	
Other vegetables	24 493	26 255	23 296	+ 5	
Total vegetable traffic . . .	139 041	130 722	115 633	+ 20	
<i>Principal destinations:</i>					
France	Paris	29 000	30 800	28 700	+ 1
	Lyons	10 300	12 500	7 600	+ 35
	Saint Etienne	6 400	7 600	4 700	+ 36
	Other companies	19 300	18 100	12 000	+ 61
Abroad	Germany	14 300	6 900	8 000	+ 79
	England	1 300	600	800	+ 62
	Switzerland	12 700	11 300	9 900	+ 28
	Other countries (Belgium, Austria, etc.)	1 300	1 600	1 200	+ 8
Algerian contribution					
	6 600	8 200	9 100	— 27	

(1) 1 metric ton = 0.9842 long ton.

The Company has 2847 fast vans (type H. P.) ; these are well ventilated ; the walls and roof are double, with an air-jacket, so that delicate goods keep well.

The Company has sent commercial agents to study packing and outlets for produce on the spot. It has got into direct communication with foreign purchasers and the French producers. It has published notices on exporting and distributed them free. At the Marseilles and other exhibitions it arranged packing competitions ; it also defrays the expenses of exhibits of the " United P. L. M. Producers " : these took 82 prizes at Turin in 1911. In Paris, in 1913, it arranged an exhibit covering 700 sq. yds. and containing 5 000 dozen flowers from the Riviera. Educational journeys to London, Scotland, Belgium and Holland have been arranged for producers.

On the Paris market the Company keeps an inspector to settle small differences on the spot ; he also considers proposals for improving the service.

In 1909 it distributed in the Carpentras district thousands of plants of a strawberry much in favour in Germany ; in 1911 and 1912 Mirabelle plum trees and greengage trees were distributed, as well as plum grafts. Grafts of very late table grapes were also distributed, and in 1912 and 1913 tomato seeds from Naples. It has experts to advise as to planting, and arranges lectures, field demonstrations and agricultural journeys in France and abroad. Further a series entitled " Publications of the P. L. M. Co. " has been printed.

Lastly, freights have been lowered on its own system, as well as for through carriage to other systems and foreign railways. In this connection a prize of 100 fr. (£ 4) has been arranged for prunes leaving France by the Nord and Ouest Cos.

Flower trade. — The principal lines for flowers from the Riviera are :

Paris.

England via Boulogne.

Germany via Petite Croix.

Belgium, Holland and Germany via Jcumont-Herbestal.

Almost all the Riviera flowers are sent in postal packages of 5 kg. (11 lbs.) ; they are packed in flat reed baskets, which are stacked in ordinary vans.

Table III shows the extent of the traffic in the last ten years.

TABLE III. — *Flowers carried by the P. L. M. (metric tons).*

Winters	Paris	England	Germany via Petit-Croix and via Paris	Geneva and Switzer- land	Beyond Paris, various	Total
1903-1904	2 692	2 381	1 126	115	814	7 128
1904-1905	2 037	1 813	1 061	134	1 152	6 197
1905-1906	2 648	2 311	1 953	173	656	7 741
1906-1907	2 504	1 808	1 825	190	714	7 041
1907-1908	2 757	2 168	2 629	171	731	8 456
1908-1909	3 401	2 171	2 982	181	1 194	9 929
1909-1910	3 338	1,872	3 272	196	1 096	9 768
1910-1911	3 568	2 256	3 504	211	1 260	10 799
1911-1912	3 686	2 110	3 156	198	1 217	10 367
1912-1913 (1)	3 836	2 547	3 620	232	1 348	11 583

(1) From October 1912 to end of March 1913.

A collecting train arriving at Marseilles at 6.30 p.m. brings in the vans from the various stations, the most distant having started at 11 a.m. They are forwarded to Paris by two regular fast trains, one of which runs in two parts from November 15 to May 1.

Flowers leaving Nice at 1 p.m. arrive:

Paris, next day at 10.30 a.m. (= 21 $\frac{1}{2}$ hrs.) in the early season, or 8 a.m.

(= 19 hrs.) in the height of the season.

Boulogne, next day at 6.30 p.m. (= 29 $\frac{1}{2}$ hrs.).

London, second day at 4 a.m. (= 39 hrs.).

Brussels, second day at 5 a.m. (= 40 hrs.).

Frankfort-on-Main, next day at 11 p.m. (= 33 hrs.).

Cologne, second day at 7 a.m. (= 41 hrs.).

Berlin, second day at 8 a.m. (= 42 hrs.).

Although the route from the Riviera to Berlin through France is 180 miles longer than the one through Italy (Chiasso-Bale), the time is the same and the French route costs less.

PLANT DISEASES.

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

681 - Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding Trees (1). — *Journal officiel de la République Française*, Year 46, No. 113, p. 3798. Paris, April 26, 1914.

Art. 1. — Woody plants (other than vines and resin-yielding trees), palms (rooted or not), and the fresh parts of these plants, coming from foreign countries and from the French departments of Alpes-Maritimes, Var, Bouches-du-Rhône, Gard, Hérault, Aude, Pyrénées Orientales and Corsica, may only be taken into Algeria through the ports to be designated by the Governor General of Algeria, or at the points on the Algero-Tunisian frontier to be determined by agreement between the Beylical Government and the Governor-General of Algeria.

On arrival at the ports or the points on the land-frontier, these products will be disinfected in buildings prepared for the purpose and under the direction of technical experts chosen by the Governor-General. Such disinfection will be carried out by means of a mixture containing gaseous hydrocyanic acid, the strength of which will be determined by the said technical agents.

The operation will be carried out at the expense of the interested parties. Exceptionally, when the consignments are accompanied by a phytopathological certificate granted by the Service of Phytopathological Inspection and are sent from establishments under State control, they will be exempted from disinfection, provided their freedom from all parasites is ascertained by the technical agents mentioned.

In case they are not passed, the importer may decide whether they are to be disinfected under the conditions laid down above or returned to their place of origin.

Art. 2. — Citrus fruits imported into Algeria will be disinfected under the conditions laid down in art. 1 for woody plants.

(1) See also No. 2026, *B.* June 1911 and No. 1347, *B.* Sept. 1912.

(Ed.).

Art. 3. — Infringements of the regulations of the present decree and of the orders made for carrying it out will be punished by a fine of 50 to 500 fr. (£2 to £20).

Art. 4. — Persons convicted of having introduced any of the objects mentioned in arts. 1 and 2 without declaration or by means of a false declaration or by any other fraudulent device, will be punished by imprisonment for from 1 month to 15 months and by a fine of from 50 to 500 fr.

Art. 5. — The punishments laid down in the two preceding articles will be doubled for a second offence. A second offence is established when a first judgment under this decree has been given against the offender in the previous twelve months.

Art. 6. — Article 463 of the Penal Code is applicable to convictions under the present decree.

Art. 7. — Woody and herbaceous plants coming from France will be admitted into Algeria, with the earth surrounding them, provided they have been raised in pots at establishments listed by the Ministry of Agriculture under article 9, § 6, of the International Convention of Berne. For plants coming from foreign countries, this condition will be replaced by the obligation, on the part of the interested parties, to obtain a permit, supplied by the Governor-General of Algeria previous to the despatching of the goods, and after seeing a special declaration signed by the French consular authority of the place of origin.

All the regulations of the decree of March 10, 1894, not contrary to the present decree, are maintained.

Art. 8. — The decrees of January 25 and November 22, 1909, are abrogated.

Art. 9. — The Minister for the Interior, the Minister of Finance and the Minister of Agriculture are entrusted, within their respective spheres, with the carrying out of the present decree, which will be published in the *Journal Officiel* of the French Republic and inserted in the *Bulletin Officiel* of the Government of Algeria.

61 — Act allotting 500 000 Francs to the Minister of Agriculture of France for the Control of Voles (1). — *Journal Officiel de la République Française*, Year 46, No. 116, p. 3854. Paris, April 29, 1914.

The President of the French Republic has promulgated an Act, dated April 23, 1914, of which the following is the purport:

Sole clause. — A sum amounting to 500 000 francs is granted, from the 1914 budget, in addition to the provisional grants allocated by the Acts of December 29, 1913 and February 26, 1914. The sum will be inserted in a special article of the Ministry of Agriculture, bearing the No. 27 bis, and entitled "Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Expenses of Organization of Control Measures". The present Act, discussed and passed by the Senate and by the Chamber of Deputies, will be in force as the law of the Land.

(1) See also No. 385, B. April 1914.

(Ed.).

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

683 - **Leaf-Curl in Potatoes and its Connection with Necrosis of the Phloem.** — SCHANDER, R. and TIESENHAUSEN, M. in *Mitteilungen des Kaiser Wilhelms Instituts für Landwirtschaft in Bromberg*, Vol. IV, Part 2, pp. 115-124. Berlin, 1914.

The writers wished to control the investigations of Quanjér (1913), which led him to believe that leaf-curl of potatoes (*Blattrollkrankheit*) was due to necrosis of the phloem. Among the material examined was some of the same as was used by Quanjér.

It was ascertained that : 1) Necrosis may appear in plants not affected by leaf-curl (either in quite sound plants or in plants attacked by "Kräuselkrankheit", etc.), and sometimes in a much worse form than in those affected by leaf-curl.

2) Such necrosis usually begins towards the apex of the stem, no doubt owing to the fact that the young tissues are more sensitive to assimilatory disturbances than the old ones. Further, it is more prevalent towards autumn in nearly all plants.

3) The phloem of the potato seems to be specially susceptible to this alteration, while in the tomato, which often suffers from strong leaf-curl, no important necrosis of the phloem has been observed. Thus, the phloem of the potato seems so susceptible that it may become necrosed without the plant appearing abnormal or losing its vigour.

4) General necrosis seems to be infrequent : the disease is generally limited to a portion of the phloem, so that complete interruption of the descending sap is very rare.

5) Lignification of the necrosed phloem has never been observed.

The writers believe this condition to be a secondary one, appearing in consequence of functional disturbances taking place in the leaves.

684 - **Observations on Bramble-leaf of Vines in Hungary** (1). — BERNATSKY, J. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 3, pp. 129-139, figs. 1-2. Stuttgart, 1914.

From observations in the vine districts of Hungary, the writer has ascertained the following facts with regard to the bramble-leaf disease (*Krautern des Weinstockes*).

1. It attacks old American stocks only on low ground, particularly depressions and valley-bottoms, on damp, rich and heavy soil. A rise of a few feet may quite prevent the appearance of the disease in such cases.

2. Young vines, one or two years old, may be attacked in situations favourable as regards height and soil.

(1) For previous work on this disease see the following Nos.: 1911-591 (Feb.), 1883 (June); 1912-572 (March), 968 and 969 (June), 1097 (July), 1349 and 1350 (Sept.), 1570 (Nov.); 1913-67 (Jan.), 1207 (Oct.), 1302 and 1303 (Nov.), 1394 (Dec.); 1914-289 (March), 480 (May), 576 (June). (Ed.).

3. In many rather old vines examined (hybrids of *Ripestris*, *Ruparia* and *Berlandieri*) it was found that the swollen part at the top was dead; the dead tissue generally extended from the pith to the origin of the shoots. Further, there are streaks of brown wood reaching a good way down the stem, as often happens after frost damage.

4. The wood and bark of diseased vines, whether living or dead, is very incompletely differentiated, or in other words does not ripen off well.

5. It is interesting to note that diseased plants often come from grafts of poorly ripened wood; this is often the case in quite young vines in favourable situations, but yet diseased. For this reason, the writer considers the practice of using the ends or side shoots of the canes for grafts as unsound, for these parts are nearly always badly ripened.

6. The roots of vines affected by bramble-leaf were diseased, and sometimes even rotten. The writer considers this not as a result, but as the cause of the disease, and due to certain soil conditions.

7. In grafted vines (*Vinifera* on American stocks) the cause of the diseased condition is often to be found in an imperfect binding; this is particularly liable to occur with woody grafts on unrooted stocks. In good warm soils, with other conditions favourable, a complete closing of the tissues takes place later, but if the weather is unfavourable or the soil unsuitable (cool and damp), the wound tends to open wider instead of closing. Eventually it forms a cankerous growth, and the wood at the point of union is soft and hypertrophied, and finally dies. This disturbance of the relations between graft and stock shows itself later in the production of the bramble-leaf condition.

8. Even when the binding is perfect, the disease may appear. It is suggested that this may be due to damaging of the graft (e. g. by frost).

9. In grafted vines affected by the disease, the stock often throws out suckers, which also become diseased.

10. In making herbaceous grafts, the suckers are often not removed till the vine is planted out; they then leave open wounds, which may, under unfavourable conditions, spread and become cankerous, thus encouraging disease in the plant.

11. Parasites have sometimes been found to cause the disease, but only when present on the roots; of these cockchafer grubs (*Melolontha vulgaris*) are the most important, though *Phylloxera* may sometimes provoke it.

It thus appears that the cause of bramble-leaf is to be sought in conditions which act only indirectly on the canes, the trouble being deep-seated or the result of causes which have disturbed the whole plant.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

- 685 - **On the Presence of Sori and Mycelium of Rusts in the Caryopses of Cereals.** — ERIKSSON, JACOB in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 1st Half-year, Vol. 158, No. 17 (April 27, 1914), pp. 1194-1196. Paris, 1914.

Referring to Beauverie's observations (1) on the presence of the sori and mycelium of rusts in the caryopses of cereals and other Gramineæ, the writer remarks that he had already described and figured this in 1896; in 1901 he expressed the opinion that the presence of the sori and mycelium is to be considered as an abnormal and excessive growth, without practical importance in the life of the fungus. After the publication by F. J. Pritchard of similar observations in the United States, Eriksson made known in 1912 his own results on the wintering of cereal rusts. Results obtained since have confirmed the opinion that the presence of mycelium and clusters of spores on the surface of the caryopses is without importance.

RESISTANT
PLANTS

- 686 - **Resistance of Hybrid Direct-Bearer Vines to Mildew.** — PÉE-LABY, E. in *La Vie agricole et rurale*, Year 3, No. 22, pp. 603-605. Paris, 1914.

One of the most important properties of hybrid direct-bearers is their resistance to mildew (*Plasmopara viticola*). The following among the older hybrid: have been thoroughly tested in this respect in various parts of France: Seibel Nos. 1, 2, 63, 110, 138, 1000, 1007, 1014, 1015, 1070, 1077, 2003, 2007 and 2041; Couderc Nos. 503, 4401, 7103, 7120, 28-112 and 106-48. All these can do without copper-sulphate spraying in moderate mildew years. The following should under ordinary circumstances be sprayed twice: Seibel Nos. 47, 60, 128, 1020, 1200, 2042 and 2044.

Various newer hybrids appear to require only two sprayings, but have not yet been sufficiently tested; many of these yield better wines than the older ones, so that it is to be hoped that their mildew resistance will be confirmed. The following white hybrids may be recommended: Girerd No. 157; Seibel Nos. 880 (which might do without spraying), 793, 850, 2791, 3010, 3021 and 4681; several Malègue types, several Couderc and two Bertylle-Seyve.

Two new rose-coloured direct-bearers (Seibel Nos. 2859 and 2677) also appear to be sufficiently protected by two sprayings.

BACTERIAL
AND FUNGOID
DISEASES OF
VARIOUS CROPS

- 687 - **Wilt Disease of Sweet Potato.** — HARTER, I. L. and FIELD, ETHEL C. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 4, pp. 204-207. Stuttgart, 1914.

The wilt disease of sweet potatoes is characterized by the wilting of the whole plant or parts of it; the diseased portions become discoloured and die; no wrinkling of the leaves takes place in such cases. The agent or agents of the disease occur in the vascular bundles of roots, stem and leaves.

(1) See No. 879, *B.* July 1913 and No. 73, *B.* Jan. 1914.

(Ed.).

Nectria Ipomoeae Hals. has generally been considered the cause of the disease, but a series of inoculations (1500) with various species of *Fusarium* isolated from the xylem of roots and stems and from tubers wholly or partly decayed, have shown that *F. hyperoxysporum* Wr. (isolated from the xylem of the stem) and *F. Batatatis* Wr. (from the vascular bundles of the root) are both parasites capable of producing the symptoms of wilt disease.

Inoculations of *Ipomoea Batatas* Poir. with *F. hyperoxysporum* produced 78 per cent. of infections, while with *F. Batatatis* 45 per cent. became diseased. The cultures of the latter were obtained from various parts of the United States (Maryland, New Jersey, Virginia and Delaware).

Inoculations with both species of *Fusarium* were tried on other plants: *Solanum tuberosum* L., *S. Melongena*, *Lycopersicum esculentum* Mill., *Ipomoea purpurea* Roth., *I. hederacea* Jacq., *I. coccinea* L., and *I. lacunosa* L. Only with *I. hederacea*, which grows wild in sweet-potato fields, were positive results obtained; both species gave infection. It is probable that the disease is spread by means of this weed.

Inoculations with *Nectria Ipomoeae* were entirely without result, so that this fungus appears not to be the cause of the disease. It appears that various species of *Fusarium*, in particular *F. oxysporum* Schlecht., *F. culmorum* W. Smith, *F. orthoceras* App. et Wr. and *F. caudatum* Wr., bring about the rotting of stored sweet potatoes.

688 - Black Spots on Tomatoes caused by *Cladosporium herbarum*. —

PEROTTI, R. and CRISTOFOLETTI, U. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part 3, pp. 169-216, figs. 1-9, plates IX-XI. Modena, 1914.

Tomatoes of a variety with fruits in clusters have frequently been observed late in the season with olive-black spots on them; these are nearly circular, and gradually increase in size: they are due to *Cladosporium herbarum*.

On naturally-occurring spots a bacterium has always been found with the *Cladosporium*: this is described as new under the name of *Pseudomonas polychromigena*. An undescribed form of *Oospora* (*Oidium*) *lactis*, var. *Solani*, is also frequently present.

The writers have investigated the morphology, physiology and pathogenic character of the *Cladosporium* and the *Pseudomonas*, as well as the relation of the *Oospora* and the *Pseudomonas* to the *Cladosporium* in the attack on the fruits.

The *Pseudomonas* is in no way parasitic, its development being permitted by the reduction of the acidity of the sap due to the attack of *Cladosporium*.

The *Oospora* is a true parasite of the tomato fruit, but takes no direct part in the formation of the spots. The *Pseudomonas* and the *Oospora* both tend to hinder the development of the *Cladosporium*, restricting and reducing the rapidity of its attack on the fruit.

The *Cladosporium* seems to infect the fruit through small breaks in the skin.

The proportion of fruit attacked in the variety in question is between 5 and 10 per cent. At present the disease does not seem serious, but

should it become so, the best course to pursue would be to grow varieties resisting it.

- 689 — **The Anatomical and Physiological Conditions of Chestnut Branches attacked by the Ink Disease.** — PETRI, I. in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIII, Series 5, 1st Half-year, No. 5, pp. 363-369. Rome, 1914.

The writer has already expressed the opinion that *Coryneum modonum* Griff. et Maubl. (which he considers identical with *C. perniciosum* Briosi et Farneti) should be regarded as one of the agents in the rapid withering of the branches of chestnuts attacked by ink disease (a black rot of the roots and the stool), and not as a cause of the disease.

In 1913 investigations were made on the physiological condition of the twigs in trees attacked by the disease.

Branches three to nine years old were collected from diseased and healthy trees in the chestnut-woods of Soriano nel Cimino (Latium) at the end of November 1913, when the trees had just lost their leaves. Various differences were found, chiefly by micro- and macrochemical means, between the branches from healthy and from diseased trees. The decreased content of certain minerals, such as lime, sulphur and potash, and the increased content of magnesia, are evidences of a diseased condition, due no doubt to disturbances in the functioning of the root-system. It is in the mineral food that the earliest and most serious irregularity takes place. The destruction of chlorophyll and the disorganization of the chloroplasts in the cortical parenchyma should be considered as the natural consequences of assimilatory disturbances and reduced vitality of the protoplasm, closely connected with the high acidity, absence or reduction of calcium oxalate, and increase of gallic acid.

These conditions no doubt allow the twigs to be attacked by weak parasites some time before any diseased condition is visible.

INSECT PESTS.

GENERALITIES

- 690 — **Insects injurious to Crops in the Nyasaland Protectorate.** — BALLARD, E. in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 347-351. London, 1914.

The following insects have been collected on or bred from cultivated plants in 1911 to 1913; unless otherwise stated they are from the Upper Shire district.

ORTHOPTERA. — *Acridiidae*. — *Maura bolivari* Kirby and *Chrotogonus* sp. are very destructive to seedling tobacco. The following also damage tobacco to some extent: *Acrida turrita* L. (Lower Shire), *Zonocerus elegans* Thunb., *Catantops opulentus* Karsch, *C. solitarius* Karsch, *C. vittipes* Sauss., *C. melanostictus* Schaum, *Morphacris fasciatus* Thunb., *Oedaleus citrinus* Sauss., *Gastrimargus marmoratus* Thunb., *G. wahlbergi* Stål, *Acrotylus patruelis* H. S., *Oxyrrhypes procera* Burm. and *Acridium lineatum* Stål.

Gryllidae. — *Brachytrypes membranaceus* sometimes damages cotton by eating the roots.

LEPIDOPTERA. — *Noctuidae*. — The red bollworm (*Diparopsis castanea* Hmp.) is very injurious to cotton throughout the Protectorate; *Chloridea obsoleta* F. occurs everywhere with it, and besides destroying the bolls and flowers of cotton, attacks maize, tobacco capsules and chick-peas. *Earias insulana* is not as bad a pest of cotton as the previous two, possibly owing to its being severely parasitized by an Ichneumonid: it is generally distributed throughout the Protectorate and has been found on *Hibiscus*. *Euxoa segetum* Schiff. gnaws the stems of tobacco in January and February. *Prodenia litura* F. is worst in the tobacco seed-beds, but it also damages tobacco after planting out, and has been found on cotton and maize, and even once on tea. The larvae of *Plusia orichalcea* F., *P. chalcites*, *Cosmophila erosa* H. B., *Gonitis sabulifera* Guén. and *Acontia graellsii* Feisth. are more or less injurious to cotton, eating the leaves up to the time of flowering; on the Upper Shire they are about from December to the middle of March. *Busseola fusca* is one of the worst pests in the Protectorate, boring into the stalks of maize and millet. *Pteronycta fasciata* Hmp. (newly described) is uncommon, but would be very injurious if it were to increase in numbers, as the larva bores into cotton stems to pupate; the slightest wind is enough to break one of the bored stems, so that the plant then dies.

Limacodidae. — *Parasa vivida* Walk. occasionally appears on coffee, doing considerable damage.

Lymantriidae. — *Heteronygmia leucogyna* Hmp. is common on mahogany (*Khaya senegalensis*); plantations near Somba have been almost completely defoliated by it.

Pyrallidae. — The cotton leaf-rolling caterpillar (*Sylepta derogata* F.) is rare on cotton in the Upper Shire, at any rate about Somba; further north, on the banks of Lake Nyasa, it is much more frequent and injurious. The larvae are largely parasitized by a Chalcidid.

Tineidae. — *Phthorimaea heliopa* Lower bores into the stems of young tobacco plants, and is most injurious in the seed-beds. *Gracilaria* (sp. nov.) is common, but not much to be feared; the larvae mine cotton leaves, but seem to have little effect on vigorous plants.

Nymphalidae. — *Hypolimnas misippus* L. was once found in a cotton-field, some plants being defoliated by considerable numbers of the larvae.

COLEOPTERA. — *Lagriidae*. — *Lagria villosa* F. devours the flowers and leaves of pulse crops.

Galerucidae. — *Ootheca mutabilis* Sahl. occurs on cotton, Leguminosæ and Cucurbitaceæ, being especially destructive to the flowers of native melons. *Diacantha conifera* Fairm. attacks Cucurbitaceæ and Leguminosæ. The imago of *Asbecesta cyanipennis* Har. eats the leaves of Leguminosæ, but is not very harmful. *Pachytoma gigantea* was found damaging the leaders of young cypresses in plantations at Mlanje, on the top of Mount Somba.

Tenebrionidae. — *Zophosis* sp. (adult) is sometimes injurious to cotton and tobacco, while *Gonocephalum simplex* F. does a little damage in tobacco plantations.

Dermestidae. — *Dermestes vulpinus* F. is common in houses.

Mcloidiæ. — *Mylabris tricolor* Gerst., *M. amplexans* Gerst., *M. dicincta* Bert. and *Decatoma catenata* Gerst. destroy cotton flowers, while *Ceroctis trifurca* Gerst. eats the flowers of soy beans and velvet beans (*Mucuna pruriens* var. *edulis*).

Curculionidæ. — The larvæ of *Apion armipes* Wagn. bore into cotton stems; a swelling is produced at the injured part, and the stem may break in a strong wind; the insect is capable of doing considerable damage and appears to be generally common in the Upper Shiré. *Calandra oryza* is very injurious to stored maize and rice. A species of *Isaniris* is common; the adult eats cotton leaves, but does not do much harm.

Coccinellidæ. — *Epilachna dregei* Muls., *E. hirta* Thunb. and *E. paykulli* Muls. are harmful in gardens. *Chilomenes lunata* F. is very useful in destroying *Aphis gossypii*.

Cassididæ. — *Cassida gibbipennis* is somewhat injurious to Leguminosæ.

Nitidulidæ. — *Epuraea* sp. eats the stamens of cotton flowers, but is of little importance.

Ptinidæ. — *Lasioderma serricorne* F. tunnels into cigars and cigarettes.

HYMENOPTERA. — *Tenthredinidæ*. — *Athalia* sp. is very injurious to turnips and cabbages.

RHYNCHOTA. — *Aphididæ*. — The cotton aphid (*Aphis gossypii* Glover) is very harmful in some seasons, especially those with heavy rainfall. *A. brassicae* L. is abundant on cabbages and difficult to destroy with washes owing to its waxy covering. Another species damages beans. *Ceratalphis latanise* Newst. has occurred on *Raphia vinifera* in the Botanic Garden at Somba.

Coccidæ. — *Pulvinaria jacksoni* Newst. has been noted in small numbers on cotton.

Coreidæ. — *Anoplocnemis curvipes* F. does some damage to cotton by sucking the sap; it has also been observed puncturing young shoots of mahogany.

Pentatomidæ. — *Antestia variegata* Thunb. damages coffee berries, while *Atlocera stictica* Westw. sucks the young shoots of mahogany.

Pyrrhocoridæ. — The cotton stainer (*Dysdercus nigrofasciatus* Stål.) occurs throughout the Protectorate and is very injurious; *Odontopus confusus* Dist. has the same habits, but is restricted to the lower and hotter parts.

691 — Contribution to the Biology of *Bibio hortulanus*, and its Control. — MOLZ, E. and PIETSCH, W. in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. X, 1914, Parts 3 and 4, pp. 98-105 and 121-125. Berlin-Schöneberg, 1914.

Bibio hortulanus appeared in the Province of Saxony (Prussia) in quite epidemic form in 1913; previously it had only been known to injure beets, but in this season it attacked spring crops of barley and wheat so severely that many fields had to be ploughed up and resown.

The damage is due to the larvae, which go on feeding up till the beginning of May, when they pupate at 2 to 4 in. below the surface of the soil.

The writers have carried out a long series of laboratory experiments with chemicals and other means for the destruction of the larvae, as well as observations on the life-history with a view to finding a point of attack. Steeping of the seed gave no results, and contact poisons (sulphate of iron, soft soap) had very little effect on the larvae.

The following measures seem to give good results :

1) In cases of severe damage in spring, the land should be ploughed deeply at the time of pupation (which begins in early May) and then well rolled ; in this way a large number of the insects are prevented from reaching the surface, while those which do so will be much weakened. If it is necessary to plough earlier in preparation for another crop (say the middle of April), thorough harrowing should follow, so as to injure the larvae ; in this case little damage is likely to be done to the second crop, though a number of insects will emerge.

2) The best means of destroying the adults is to place wisps of straw on sticks about a yard high, in the places where the larvae have been noticed, at the time of emergence of the gnats : this begins about the 20th of May, only isolated individuals being observed as early as the 10th. The gnats settle by preference on these wisps, and can be collected and killed on cool mornings : several hundred may be found on a single wisp.

3) Care should be taken that no dung, particularly stable dung, is lying about at the time of emergence of the gnats ; farmers believe that the insects are spread by means of stable dung.

The abundance of these gnats in the Saxon province is very likely connected with the prevalence of beet aphids (*Aphis papaveris*) in 1911 and 1912, as the honeydew produced by them is very attractive to the gnats.

692 - *Anagrus orijentatus*, a Hymenopterous Parasite of the Eggs of *Lygus pratensis*. (1) — CROSSY, C. R. and LEONARD, M. D. in *The Canadian Entomologist*, Vol. XLVI, No. 5, pp. 181-182, figs. 19-20. London, 1914.

MEANS OF
PREVENTION
AND CONTROL.

From an egg of *Lygus pratensis* on *Erigeron ramosus*, obtained at Ithaca (New York) in October 1913, a Hymenopterous parasite was reared ; others were also obtained by enclosing heads of the plant in breeding-cages. It appears to be a new species, and is described under the name of *Anagrus orijentatus* ; it is near *A. saga* Girault, but differs from this in several particulars.

693 - A Nematode Parasite of the Olive Weevil (*Rhynchites ruber*). — DEL GUERCIO, G. in *Redia, Giornale di Entomologia*, Vol. IX, Part. 2, pp. 233-234. Florence, 1914.

The great irregularity in the appearance of the olive weevil (*Rhynchites ruber* Fairm.) (2) and in the amount of damage it does is very likely due in part to the presence of a so far unrecorded parasite : this is a minute Nematode worm, apparently a *Rhabditis*, which the writer has noticed since 1911. The worms attack the larvae when they leave the olives and burrow into

(1) See also No. 1381, B. Sept. 1912.

(Ed.).

(2) See No. 1240, B. Aug. 1912.

(Ed.).

the ground. Once inside the larva, the worm grows and reproduces, so that the host becomes a centre of infection for other larvae. The infected larva eventually becomes motionless and dies. After death the body becomes covered with a whitish felt, consisting of numbers of the Nematodes; they are very prolific, so that the number hatching from the eggs is enormous.

- 694 - **Control of the Second Generation of Vine Moths by means of Protecting Envelopes.** — MILANI, A. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 3, pp. 139-148. Stuttgart, 1914.

The writer has made trials of the protecting envelopes (German patent No. 250 053, July 1, 1911) for use against the second generation of the vine moths (*Conchylis ambiguella* and *Polychrosis botrana*); these were carried out in the three seasons 1911-1913, in conjunction with the Vine-growing College at Geisenheim (Germany). The envelopes in question are conical and open below, and the opening is gummed; they are put over the flower clusters in June, and the moths coming to lay are caught by the gum.

It has been found that grapes so protected were hardly damaged at all, while the unprotected ones were sometimes severely damaged.

INSECTS
INJURIOUS
TO VARIOUS
CROPS

- 695 - ***Lachnodius greeni*, a New Scale injurious to Coffee in Madagascar.** — VAYSSIÈRE, P. — *Bulletin de la Société entomologique de France*, 1914, No. 5, pp. 156-157. Paris, 1914. — *Journal d'Agriculture tropicale*, Year 14, No. 154, p. 125. Paris, 1914.

The writer describes under the name of *Lachnodius greeni* a new scale-insect sent to the Paris Entomological Station by M. Fauchère, inspector of colonial agriculture in Madagascar. This species occurs in clusters on the roots and stems of coffee, covered over by cells of earth and bark made by ants. It appears to be a serious pest of *Coffea robusta* and *C. liberica*.

Treatment should if possible be carried out before the scales are covered up by the ants. The bottom of the stem and the parts of the roots attacked should be laid bare and then washed with a petroleum insecticide strong enough to destroy the insects without damaging the plants. Proper attention to the plants will also help them to resist the scale and other enemies.

- 696 - **The Yellow-headed Coffee Borer (*Dirphya princeps*) in Uganda.** — GOWDEX, C. C. in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 279-281, 2 figs. London, 1914.

Dirphya (Nilocris) princeps Jord. (Cerambycidae) was first recognized in Uganda as injurious to *Coffea robusta* in 1910; it has since been found on *C. arabica* also.

The bushes attacked can readily be recognized by the accumulations of excreta and gnawed wood below them. The branch through which the larva has made its way into the main stem can generally also be recognized either by the openings of the horizontal tunnels in it or by its tip having turned black: the latter occurrence is, however, not to be relied upon.

If the larva is still in the side branch, the simplest way to destroy it is to cut off the branch and burn it. If it has gone into the main stem the best thing is to inject a few drops of carbon disulphide or carbon tetrachloride into the gallery; the side branch through which it has entered should

be cut off close to the stem, so that the opening can be used for the injection; this and all other openings should then be closed with damp clay.

If the larvae are not killed, the tree soon dies or else gets broken by the wind. Coffee bushes less than two years old do not seem to be attacked.

697 - ***Pseudococcus filamentosus*, a Scale injurious to Tropical Trees.** -

VAYSSIERE, P. in *Journal d'Agriculture tropicale*, Year 14, No. 154, pp. 109-111. Paris, 1914.

Pseudococcus filamentosus Ckll. (= *Dactylopius perniciosus*) was first recorded about twenty years ago in Hawaii; it has since spread to various parts of the world.

In 1899 it occurred in Mauritius on Euphorbiaceae and citrus fruits; later it was reported from Jamaica. In 1906 it was found in Cairo on cotton and *Albizzia Lebbek*, and by 1909 it had become a serious pest of the *Albizzia* trees along the avenues of the city. In 1912 the writer recorded it in French West Africa (Koulikoro, Upper Senegal-Niger) on *Ximenia americana*. In 1913, German East Africa was stated to be the original home of this scale; it was observed there on native cotton in 1909, and in 1911 was found to be highly injurious to ornamental trees in Daressalam.

A tree infested by this insect has its branches and leaves covered by masses of white filamentous waxy matter, which sometimes form sheets joining one branch to another. Among these masses can be found adult females, eggs and larvae. The recently-hatched larvae migrate in quantities to the young branches and leaves; thence they are easily carried by the wind, birds or insects to considerable distances.

Severely attacked trees may be killed in a few months. Infection almost always begins at the top; first the leaves turn brown and fall off, then the branches also wither and die. Hundreds of trees were killed in this way in Cairo, and also in Honolulu at the time of the outbreak in Hawaii (1891).

Till lately the number of host-plants known was limited, but at Daressalam it has attacked a great variety of trees. The most favoured are the following: *Albizzia Lebbek*, *Pongamia glabra*, *Pithecolobium Saman*, *Eriodendron anfractuosum*, *Citrus*, *Acacia arabica* and *Loranthus*; the latter, being a parasite of various trees, tends to weaken them and make them more susceptible to the scale. At the same time, the *Terminalia* trees at Daressalam, though parasitized by species of *Loranthus*, were hardly attacked.

Other trees resistant to this scale are: the species of *Eucalyptus*, *Pandanus*, *Plumeria*, *Bauhinia* and *Bougainvillea*, as well as *Pithecolobium dulce*, *Syzygium guineense*, *Barringtonia racemosa*, *Anacardium occidentale*, various species of *Sterculia*, etc. Occasional hosts are: *Sapindus Saponaria*, *Chrysophyllum Cainito*, *Landolphia* sp., various species of *Ficus* and *Bambusa*, *Khaya senegalensis*, cottons, palms, *Melia Azedarach*, various species of *Agave* and *Albizzia*, *Ximenia americana*, etc. *Mangifera indica*, which was badly attacked at Daressalam in 1912, should also be classed here.

Among natural enemies so far known should be mentioned two Chalcidids (Hymenoptera), as internal parasites in Egypt, a predatory Hemerobid

larva (Neuroptera) in Cairo, and three Coccinellids: *Exochomus nigromaculatus*, *Scymnus includens* and *Cryptolaemus montrouzieri*. The last-named ladybird, coming from the Cape, was found very efficient against this scale in Hawaii, and should be acclimatized in various parts of Africa to keep scales in check.

In new centres of infection cultural methods and insecticides should be given preference over introduction of natural enemies. In particular, resistant species of trees should be chosen for parks and avenues, and infested trees of no economic value should be destroyed; *Loranthus* should also be removed. The best insecticide seems to be petroleum emulsion (6 to 15 per cent.) applied as a winter wash; mixtures of petroleum, soap and lime are also good.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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FIRST PART.
ORIGINAL ARTICLES

Agricultural Education in the Netherlands

by

Dr. K. H. M. VAN DER ZANDE.

Inspector of Agricultural Education.

HIGHER AGRICULTURAL EDUCATION.

The seat of higher agricultural education is the National College of Agriculture, Horticulture and Forestry at Wageningen. Previous to 1906 this college was connected with the National Agricultural School at Groningen, the National Horticultural School and the Municipal College, all four being under the management of the same board. Since its separation from these other institutions the Wageningen College has undergone considerable development both as regards attendance and equipment. Teaching is now conducted on academical lines; the courses are open to all, but only students who have been through the secondary schools (modern or classical) are admitted to the examinations. It already possesses good laboratories, a library, buildings for feeding experiments, etc., about 100 acres of land and a special hothouse for tropical plants. The following institutions are attached to the College: 1. Phytopathological Institute, which is also the headquarters of the Government Service for the protection of plants. 2. The Institute for Agricultural Machinery and Construction. 3. The Institute for the Sugar Industry, which undertakes more especially the training of young men for the East Indian sugar plantations. 4. The recently founded Plant Breeding Institute.

The staff of the College consists of 28 lecturers and a number of assistants. Instruction is given in all branches of agriculture, horticulture and forestry, both Dutch and tropical. At present 247 students are in attendance; of these, 34 have specialised in Dutch agriculture, 39 in tropical agriculture, 6 in horticulture, 5 in Dutch forestry and 44 in tropical forestry. The remaining 119 students are still following the preliminary unspecialised courses.

2. SECONDARY AGRICULTURAL EDUCATION.

The secondary agricultural schools comprise the National Agricultural School at Groningen and the Colonial School at Deventer. In 1896 a so-called "Indian class" was founded at the National Agricultural School to deal with tropical farming. In the colonial school the course lasts three years, at the Groningen school two and a half years. Both schools are well equipped as regards qualified masters for teaching natural science, agriculture and other technical subjects. (For curriculum, etc., see Tables I and II in appendix).

3. SPECIAL SCHOOLS AND SPECIAL COURSES.

(a) *National Dairy School at Bolsward.* — The course at this school extends over two years and is intended specially for managers of butter and cheese factories. Besides practical cheese and butter making the principles of commerce, book keeping and commercial correspondence in French, German and English are taught. Only students who have had at least eighteen months' practical work in a butter or cheese factory are admitted, and they must undertake to work in a dairy during their vacation, producing a certificate to that effect at the end of the vacation. Forty students were in attendance in the year 1912-1913.

(b) *Agricultural and Horticultural Winter Schools.* — The course at these schools lasts over two winter terms. There are at present in the Netherlands 9 agricultural and 5 horticultural winter schools, which are on the whole very well attended and much appreciated by the country people. They are especially adapted for lads whose presence at home is indispensable during the summer or whose means do not allow them to attend a secondary agricultural school. In order to be admitted, it is sufficient to have passed through the elementary schools, though the winter schools are also frequented by lads who have had a rather better education. The instruction given is purely theoretical, like that given in the National Agricultural College and in the secondary agricultural schools, and it is adapted to the special agricultural conditions of the districts in which the schools are situated. In the horticultural schools some facility for practical work is afforded by the school gardens. In the year 1912 the agricultural and horticultural schools were attended by 349 and 155 pupils respectively.

The directors of these schools are usually specially qualified in agriculture or horticulture and have under them one or two permanent teachers and some temporary elementary school teachers. Further details of the curriculum are given in Tables III and IV. Only pupils over 16 years of age are admitted, for in the Netherlands, as in other places, experience has shown that the older pupils profit most by the instruction. It is very desirable that the lads should attend continuation classes in the interval between leaving the elementary schools and joining the winter schools. Such classes exist in the country, but hitherto too little has been done for their development.

The fees at the winter schools are low, at most 16s per term, while books etc. amount to about £2 per head. As most of the pupils live in the immediate neighbourhood of the schools their total expenses are very moderate. If the pupil cannot afford it, the payment of the fees is not insisted upon and in such cases the books are also frequently supplied free of charge by the school. Scholarships are available besides, and allowances are made by associations and by the local authorities.

All winter schools are national institutions; this year, however, the Catholic Association for Agricultural Education will open a private winter school which will also receive a State grant. There is further a school of horticulture, which is not a winter school proper but resembles it in character. It was founded by the Frederiksoord Beneficent Association with funds given by General van Swieten.

(c) *Winter courses in agriculture and horticulture.* — This form of education is especially intended for those young farmers and gardeners whose presence at home cannot be dispensed with for any length of time even in winter. The courses generally extend over two winters and include from 300 to 400 hours of instruction. The lecturers are elementary school teachers who have undergone special training in agriculture and horticulture.

The courses in agriculture and horticulture are organised privately by associations and occasionally by local authorities, but they are subventioned by the State, which generally pays the lecturers and provides the material. Such courses are in great request throughout the country, and their number is constantly increasing. Unfortunately suitable lecturers are often wanting, but it is hoped that their numbers will soon increase, as special provision is being made for their training. In the year 1912-13 a total of 405 courses on agriculture and 119 courses on horticulture was held, with an attendance of 6015 and 2203 pupils respectively.

(d) *Agricultural and horticultural courses for adults and special courses.* — These courses, as a rule, consist of twelve lectures lasting two hours each. The lecturers are usually teachers with much practical experience. In the winter 1912-1913, 131 agricultural courses and 78 horticultural courses were held and they were attended by 3729 and 1567 students respectively.

Special courses are given in poultry keeping, horse shoeing, and live stock management.

(e) *Agricultural instruction for soldiers.* — On request of the military authorities, instruction in agriculture has been given to the soldiers of some garrisons since 1905. This is especially intended for those men who have been brought up in the country. A whole course consists as a rule of 12 lectures of two hours each on questions connected with manuring and live stock management. The lectures are generally well attended. In the winter of 1912-1913 these courses were held in 16 localities and attended by 565 soldiers.

(f) *Agricultural education for women.* — During the last few years, a start has also been made with regard to instructing the female rural population. In this respect the Netherlands are perhaps behind several other countries.

Formerly when butter and cheese were made in almost every farmhouse, special courses were held in these subjects. At present except in a few districts in South Holland and in the province of Utrecht, butter and cheese are made exclusively in factories, and dairy courses are only held in the limited districts mentioned above. In districts with light sandy soils, where small holdings are very numerous, special courses on livestock management, feeding, etc., are held for women. Of still greater importance, however, are the courses on domestic subjects, such as cooking, housework, first aid, gardening. In general the tendency is to get women teachers for the purely domestic subjects and special agricultural or horticultural teachers and medical men for the others.

Hitherto domestic economy has only been taught in short courses. Only one permanent school exists in the country, that at Lierop, which was opened in 1911; it is chiefly a cookery school for peasant women conducted by Catholic sisters. This year a new National School of Domestic Economy will be opened; for the present, only teachers of domestic economy will be trained in it. The courses on domestic economy are usually organized by agricultural associations who have special grants from the Government. In the year 1912, 53 courses were held, and attended by 1100 women students. In some places courses have been held for the wives of agricultural labourers; they have awakened much interest and will be continued.

With regard to the amounts of money granted by the Government for agricultural education, it should be noted that out of the total population of 5 411 800 inhabitants, about 2 683 800 live in the towns and 2 728 000 in the country. In the budget for 1913 the following sums were voted:

For the National College of Agriculture, Horticulture and Forestry.	£ 22 875
For the two Secondary Agricultural Schools	" 7 464
For the National Butter and Cheese-making School	" 1 136
For the Agricultural and Horticultural Winter Schools	" 9 183
For other courses	" 16 333

Besides the Government grants, contributions to agricultural education are also made by associations and local authorities, but as these vary greatly no reliable data can be given.

Appendix.

TABLE I. — *Curriculum of the Secondary Agricultural School at Groningen.*

	Number of hours per week				
	Class I		Class II		Class III
	Winter term	Summer term	Winter term	Summer term	Winter term
<i>Natural Science</i> : Chemistry, Technology, Physics, Botany, Zoology and Mineralogy	13	11	7	6	4
History, Geography, Mathematics	8	5	1	1	3
<i>Languages</i> : Dutch, German, French, English	9	7	4	4	3
<i>Economics</i>	—	—	1	1	1
<i>Agriculture</i>	2	9	19	20	21
Total	32	32	32	32	32

TABLE II. — *Curriculum of the Secondary Colonial School at Deventer.*

	Number of hours per week		
	Class I	Class II	Class III
<i>Natural Science</i> : Physics, Chemistry, Zoology, Botany	10	9	12 ½
Mathematics, Surveying, Drawing	7	8	4
<i>Languages</i> (1): Dutch, German, English, French, Javanese, Sunda and Malay	8	5 ½	6
<i>Tropical Agriculture</i> : General, Special crops, Live stock management, Book keeping	11	15 ½	15 ½
Gymnastics, First aid	2	2	1
Total	38	40	39
Practical work included in the above time table	8	10	8

(1) German, French, Javanese and Sunda are optional subjects.

TABLE III. — *Curriculum at the Groningen Winter School.*

	Number of hours per week	
	Class I	Class II
<i>Natural Science:</i>		
Chemistry, Physics Botany, Zoology	12	7
Dutch, Arithmetic, Surveying, Mechanics	6	4
<i>Agriculture:</i>		
Soil and Plants	4-6	6
Animal husbandry and allied subjects.	10	12
Farming and Book keeping.	—	3
Total . . .	32-34	32

TABLE IV. — *Curriculum of Horticultural Winter School at Boskoop.*

	Number of hours per week		
	Class I	Class II	Class III
<i>Natural Science:</i>			
Botany, Plant Diseases, Physics and Chemistry . .	8 $\frac{3}{4}$	5	13 $\frac{3}{4}$
<i>Horticulture:</i>			
Plant breeding, Growing of ornamental trees, Fruit growing, Landscape gardening	6 $\frac{1}{2}$	10 $\frac{3}{4}$	17
<i>Commercial subjects:</i>			
Correspondence, German and English, Arithmetic, Commercial Geography, Book-keeping:	6	5 $\frac{1}{4}$	11 $\frac{1}{4}$
Total . . .	21	21	42

The Present Position of the Science of Manuring in Germany

by

Professor M. HOFFMANN, of Berlin,

Manager of the German Agricultural Society.

The discussion of this question is made easier by the publication of the symposium on "New Methods and Aims in Manuring", in the March and April numbers of *Mitteilungen der D. L. G.* for this year. In this article the leading experts express their views, and consideration of these papers

leads to the regrettable conviction that we have not yet been able to solve the weightiest problem of the science of manuring, namely how to find out, rapidly and surely, the manurial requirements of a given piece of land before a crop is put into it.

Yet there is no doubt that we have got a good deal further in this direction in the last ten years, and for this we have especially to thank the efforts of KÖNIG (at Münster), MITSCHERLICH (at Königsberg) WAGNER (at Darmstadt) and PFEIFFER (at Breslau), who have done much to increase our knowledge of the analysis of soils and crops. It is true that water containing carbonic acid was known to the older agricultural chemists as a means of obtaining a soil extract suitable for analysis, but the finer type of experimental and critical observation work was not yet undertaken.

To Mitscherlich belongs the credit of having instituted researches regarding the temperature, concentration, and duration of influence of this agent, and of obtaining partially satisfactory results from them. He succeeded in finding out, with reference to the cultivation of spring sown cereals, a regular relation between the quantities found in the carbonic soil extract and those recovered in the harvested crop, although his experiments have not yet stood the test of independent investigation.

It will be interesting to see whether the methods suggested by König for determining the assimilable mineral plant foods of the soil prove reliable. König starts from the assumption, which has a good deal to be said for it, that the pioneer work of microorganisms, yeasts and catalases in bringing into solution the compounds of potash and phosphoric acid in the soil, is most readily investigated if the soil to be examined is previously steamed under pressure. For potash requirements, König believes in steaming for 5 hours under a pressure of 5 atmospheres: as a result of his latest experiments, he arrives at certain standards, as for example that soils of which the potash content rendered soluble by steaming only amounts to 5 mgms. per 100 gms. of soil, will benefit by a potash dressing, whereas if this figure reaches 8 mgms. the soil does not need potash; in the same way a soil which after steaming, gives less than 4 mgms. of soluble phosphoric acid will profit by a dressing of phosphates. At the same time he does not wholly reject as an extracting agent the 2 per cent. citric acid solution recommended by GERLACH of Bromberg more than a decade ago. Unfortunately the indefatigable veteran experimenter has not hitherto, in the course of his comprehensive researches, been able to determine definite relations between the quantity of nitrogen and of lime taken up by plants and the absolute quantity of these substances existing in the soil. He is, however, of opinion that in this case the percentage content of the dry matter of plants provides a sufficient clue as to whether these substances are present in the soil in sufficient quantity.

Such an admission as this is a further stimulus toward plant analysis, the applicability of which has, in the last few years, been advocated by Wagner and Pfeiffer. Wagner's doctrine, according to which a meadow the more urgently needs manuring with the chief fertilizing agents, the more widely the content of its air-dried hay varies from the limit values " 2 per

cent. potash, 0.7 per cent. phosphoric acid, 1 per cent. lime", has already been many times confirmed, and steps are now being taken to establish similar standards for spring-sown cereals. In calculating an analysis of hay, the fact must be borne in mind that, as a rule (and my own investigations support this), the second cut is richer than the first in P_2O_5 and in CaO , as well as in protein, while on the other hand the potash content is lower. It may here be remarked that nitrogenous manuring for meadows and pastures has come more into fashion in Germany, in the last five years than could justifiably have been expected from the opinion hitherto prevailing on the subject.

Speaking generally, however, the pot and field experiments which Wagner has developed in so masterly a manner, continue to hold the first place in the determination of manurial requirements; Hiltner who also showed the possibility of applying potash and nitrogen to plants direct through the leaf-organs is now occupied in arranging water culture experiments with the same object.

Should the farmer not be in a position to make use of experiments, which, after all, only tell what happened on a given piece of land, he would do well to call to his assistance the so called "Soil Statics", and keep a soil account-book; though this might not be necessary for the whole farm or for the whole of the arable land, at any rate it would be of value for the individual "hungriest" fields. Soil Statics, that is, the science of balancing the intake and output of the plant foods in the soil in relation to its power of plant production, which was, before the introduction of artificial fertilizers, a much valued means of determining manurial requirements, has not achieved the success expected of it after the recent efforts to restore it to favour. All the same soil statics, as proved by my own comprehensive experiments, provide the critically minded arable farmer with a useful indicator, particularly as to whether a further application of potash and phosphoric acid is profitable; for fertilizers like nitrogen and lime, which are easily modified or washed out of the soil, the method is less suitable. The subject is fully explained in Part 251 of *Arbeiten der D. L. G.*

A fact which is not without its significance in the practical application of statistical calculations is the discovery, which has received repeated confirmation, that the ratio between the plant foods found in the composition of normal plants is something like 100 N : 50 P_2O_5 : 150 K_2O : 80 CaO , although many plants, the Leguminosae for example, show considerable divergences from these proportions. The farmer who reckons out his stock of the principle plant foods per acre for each piece of arable land on the basis of an up-to-date and complete soil analysis, and from this subtracts the quantity of plant foods contained in the forthcoming crop at harvest (allowing about 1 per cent. for wastage) on the above ratio, will be able to measure approximately, before the annual crop sowing, the quantities of manure which he must still apply to his land. In doing this, however, he must take into consideration the average coefficients of utilization of the said plant foods and all the other factors which influence the productive

capacity of the soil. If he continues this calculation in the following years, he will, of course, not need a fresh soil analysis, the previous year's figures being used as a basis.

There exists at present no method at once rapid and entirely free from objection, of determining the manurial requirements — not the plant food requirements — of a soil, and there is not likely to be one until the biological and colloido-chemical actions taking place in the soil have been more clearly defined. The work of decomposition due to bacteria, the numerous sources of production of carbonic acid and the conditions affecting the coagulation of colloid substances which is important for growth, are matters too complex and varied, even on the smallest scale, to admit of being expressed in incontestable numerical terms, in the light of our present knowledge and with our present methods of investigation.

Apart from the revival of Statics, the Law of the Minimum has very recently formed the central point of numerous investigations. The endeavour to find a symbolical representation of this fundamental Law of Nature on the basis of Wollny's definition gave rise to a keen competition, as described in detail in my report on the prize competition on this subject in Part 245 of *Arbeiten der D. L. G.* In this connection it should be noted that Mitscherlich, on the proposal of P. Mazé, wants this law, which was already known to Karl Sprengel, to be designated "The Law of Physiological Relations", since the amount of plant-production depends on the collective effect of a number of growth factors, each of which individually exercises on that amount a retarding influence proportional to its own proximity to the minimum. This suggestion may contain a germ of truth, but at the same time the name "Law of the Minimum", chosen by Liebig, will not so soon disappear from the vocabulary of practical scientists; and it may well be preserved for application in the case of plant foods, since these are factors over which man can exercise a vigorous control.

The present current of opinion in this sphere is strongly influenced by the fact that certain factors formerly regarded as being present in excess, for example carbonic acid, are now suspected of being present only in the minimum quantity. Individual experiments with ornamental plants show that flowering in glass-houses is considerably improved by applications of carbon dioxide, made by means of a cylinder, or by the action of hydrochloric acid on marble, or by burning alcohol. Similar success was looked for with agricultural crops, from the application under the soil, of carbonic acid, either in the form of gas by means of pipes, or by means of rapidly decomposing organic substances. Unfortunately this success has hitherto been practically unattained, but all the same the problem, on which we possess a number of accurate studies by earlier investigators, will still be kept in view, just as for a considerable time the question of making a more productive use of the sun's energy, in combination with artificial watering and manuring, has been under discussion.

It is not without interest to recall, in this connection, that STRACKOSCH, of Vienna, who established the "Law of the Variation of Work done by Cultivated Plants", and who started the idea of the "Assimilative Effect"

(relation between the utilizable substances produced and the quantity of plant food consumed), succeeded in obtaining an increase of yield amounting to about 11 shillings an acre by altering the cropping scheme on his estate at Hohenau in accordance with this "Assimilative Effect"; these results he described in a lecture before the Royal and Imperial Agricultural Society in Vienna. (See *Österreich Agrar-Zeitung*, 1913, No 18).

In this case "Energetics" may be said to play a part inasmuch as Strackosch avails himself, for the determination of the effective utilizable value, of Kellner's "Starch Equivalents" that is to say, of a conception based on "Energetics", as Remy has already pointed out.

Even, however, if more arable land is eventually to be permanently cropped than is at present the case, the sun's energy will still remain no more than a powerful contributing factor in the development of private and national wealth. The quintessence of human art in agriculture lies, in my opinion, in the correct application of fertilizers to well prepared soil, and in sowing productive varieties.

As SCHULZE, of Breslau, has recently shown, the remains of the roots and stubble of grain and of root-crops do not by a long way leave in the soil the quantities of plant food required for the attainment of maximum harvests; even if, in the case of Leguminosae, the whole of the aerial portion of the plants on a field were also applied as green manure, the utilization of them by the succeeding crop by means of bacterial and chemical processes, assisted by the return of plant foods from the body of the plants before they are ripe for harvest, would still, in the majority of cases, by no means come up to expectation. According to the pot experiments published by Professor VON SEELHORST in Part 241 of *Arbeiten der D. L. G.*, the losses by washing out of nitrogenous green manure are very considerable on light soils, so that the utilization during a three-course rotation may be taken at only about 30 per cent.

The same applies, in the long run, to the utilization of the nitrogen in farmyard manure, which can, however, be greatly improved by keeping the liquid and solid manure separate in the cowhouses; the liquid manure should be kept from contact with the air in a tank with a lid, and should also be covered with a layer of petroleum or oil. Ortmann, who owns the manor of Schependorf, has been trying for some time to introduce a method of storage of this kind into general use in Germany, and such endeavours are worthy of support, for with nitrogenous manures at their present price, it makes a considerable difference whether one employs liquid manure containing 1 or 2 per thousand nitrogen or that containing 6 or 7 per thousand. Recent experiments have shewn that liquid manure treated in this manner produces excellent effects, equal to those of ammonia, but it must be thoroughly covered with earth, immediately after being applied, or at least be ploughed in shallow, as in the case of farmyard manure well soaked with urine (box or yard manure). If it can only be used as a top-dressing, it is profitable to add crude sulphuric acid as a preservative.

A further series of experiments is now in progress in Germany, with the object of discovering within what limits home produced manures can

be replaced by commercial manures. The trials which have been carried on during the last 70 years on the home farm at Wingendorf near Freiberg, in Saxony, seem to show that this method of farming cannot be continued through several decades without fundamentally impairing the yield, except on good soils containing plenty of humus, and even then, only when the remains of the roots and stubble are allowed to accumulate for the enrichment of the soil.

The majority of the German farms carrying no live stock work principally with green manure or, in some parts, also with night-soil combined with heavy dressings of artificial fertilizers, while here and there manure is purchased from neighbouring towns, or straw is handed over to neighbouring farmers to be used for making manure and returned. Farms using only commercial fertilizers only exist in isolated cases, or this system is confined to the outlying portions of the farm. In any case, it has been found again and again that profitable root crops can, as a rule, only be obtained by an intelligent combination of home produced and commercial manures, while cereals following a previous crop dressed with farm-yard manure or green manure usually pay well for a complete dressing of artificial fertilizers suited to the previous crop and to the strenght of the soil. It is a universal rule in all the better managed farms, to keep the replacing of plant foods at a minimum, or, having regard to the kind of manure, crops, and soil, and to the rotation practised and the general circumstances of the farm, to approach the line of soil enrichment, taking into account the time occupied by the various farm crops in absorbing plant food.

Agricultural chemists in Germany are busily engaged in determining the utilization coefficients and the best adapted forms in which to apply both home-produced and commercial manures under the most widely varying conditions; numerous articles have been published on the agricultural value of all these fertilizing materials, especially the different forms of phosphates, potash, and above all nitrogen, such as that contained in nitrate of soda, nitrate of lime, nitrate of potash, ammonia, and organic and cyanic nitrogen. Nitrogen is the plant food most often present in the minimum quantity, and unfortunately it is also the dearest. It is therefore not surprising that it is this element which is the subject of the most extensive study, a fact which is also manifested in the numerous applications for patents having for their object the utilization, for fertilizing purposes, of the nitrogen of the air. But technical science is also endeavouring to make use of crude phosphates, minerals containing potash, and the less pure limes, and to make them available to agriculture as fertilizing materials—with what success, Pfeiffer and Lemmermann have reported in this journal. (1)

Potash salts are at present being worked at more than 150 mines, and, like amber, represent up till now a natural monopoly of Germany. The fu-

(1) See "The Possibility of Using Crude Phosphates and Limes containing Silica as Manures", by Prof. Dr. Pfeiffer, B. Sept. 1913, pp. 1326-1327; also "The Possibility of Replacing Stassfurt Salts by Finely Ground Phonolite, Leucite, etc.", by Prof. Lemmermann, B. Oct. 1913, pp. 1483-1495. (Ed.)

ture will shew whether this will continue to be the case, and whether the deposits discovered in recent years in the north of Spain and elsewhere give promise of profitable working. For the present, they can only be regarded as of historical interest, in the same way as the working of certain quartzrocks for platinum recently undertaken in Westphalia.

A special interest has become attached in the last few years to the three substances magnesia, silicic acid and sodium. Since Professor Willstätter ascertained that the colouring matter of chlorophyll contains about 4 per cent. of magnesia, but no iron, this base has received the attention it deserves, and this not only for the sake of proving Loewe's theory of the so-called "Lime Factor". Similarly, sodium and silica, which have come into prominence on account of the discussions on phonolite and the researches into the chemistry of colloids, have become the subject of recent investigations; Schulze, among others, has been able to prove a direct nutritive effect of sodium. It is true that the preparation named "Natramon", an artificial product composed of 75 parts of sulphate of ammonia to 25 parts of common salt, has not been able to establish itself in practice, but on the other hand an addition of rock salt to nitrogenous manures containing no sodium was accompanied by the most successful results, especially for plants requiring sodium, *e. g.* mangels and beets, barley and certain vegetables. As regards silica, German agricultural chemists maintain their previous opinions.

It would take too long, here, to go into the experiments which have for their object the investigation of what are called catalytic fertilizers or stimulants, such as the salts of sulphur, manganese, boron, aluminium, lithium, rubidium. As we cannot deal with questions having at present no practical significance, we must leave out of consideration the question of drilling in fertilizers and using the rotatory spreader, as opposed to the broadcasting method prevalent in this country, also the question of the applicability of powerful, high percentage preparations of urea, and the new composite manures, known as nitrate of ammonia and nitrate-phosphate, and, in general, all the latest — and unfortunately also in most cases short-lived articles which appear on the manure market. The said market seems likely soon to be brought under Government control in Germany, as already elsewhere.

It is certain that the great increase in the consumption of artificial fertilizers (see Table II, p. 984), and the corresponding increase in our crop yields (see Table I, p. 983), which represent an expenditure of some 600 million marks by the German farming industry, are due not to the superstitions of ministers nor to unsound or misleading theories, but to systematic and representative researches, clear sighted regulation of the means of communication, and distribution, on the widest scale and in the shortest time, of accurate reports of the results of experiments. In this work, apart from the advertisement departments of the great manure manufacturing houses, the chambers of agriculture and agricultural societies, (notably among them the German Agricultural Society) each have their meritorious part, as have also, in particular, the schools of agriculture with

their travelling instructors, the agricultural colleges, and, of course, the experiment stations. It should here be observed that it was also the German Agricultural Society which extended its researches from field, meadow and pasture, to orchard, vineyard, forest and lake. At the same time this Society afforded financial assistance for the training of young students in methods of research and exerted itself to bring to a satisfactory solution the interpretation of the results obtained from manurial experiments. Since the foundation of the Imperial Fund for Advertizing Potash, it has fortunately been also possible to introduce the employment of artificial fertilizers into the tropical agriculture of the German colonies in a clear-sighted and comprehensive manner, and even to establish there, for that purpose, trained agricultural chemists.

There is no doubt that, in spite of being heavily overburdened with the work of analytical control of agricultural goods, the representatives of German manurial science have made good use of their time, and that many gaps have been filled up in the sphere of knowledge entrusted to them within the last ten years through their accurate and methodical researches.

It is a matter for congratulation that the Government and other competent authorities recognize the activity and success of these experiment stations, and assist in promoting the development of all institutions of this kind. Another step to be hailed with satisfaction is that the experiment stations themselves are seeking to form separate departments for research and control—indeed many are going still further and resolving themselves into separately located and separately administered research stations and control stations. Finally, it is to be hoped that the State may gradually assume control of all experiment stations, just as in the same way the question should be considered of a uniformly regulated training for the rising generation of agricultural chemists. Then the far-reaching conceptions and the numerous details introduced in the above-mentioned symposium would more speedily attain a satisfactory solution, to the great benefit of agriculture and of political economy.

Appendix.

TABLE I. — *Average yields of the chief crops in Germany, 1890-1912 (lbs. per acre).*

	Rye	Wheat	Barley	Oats	Potatoes	Meadow hay
1890-91 — 1894-95	1 170	1 460	1 480	1 290	9 390	2 960
1895-96 — 1899-00	1 280	1 580	1 480	1 410	10 380	3 620
1900-01 — 1904-05	1 380	1 700	1 650	1 530	11 500	3 590
1905-06 — 1909-10	1 490	1 780	1 740	1 720	12 400	3 870
1911	1 590	1 850	1 780	1 590	9 230	(1) 2 910
1912	1 660	2 010	1 950	930	13 410	(1) 4 100

(1) Irrigated meadows: 1911 — 4 000 lbs.; 1912 — 4 940 lbs.

TABLE II. — *Consumption of commercial fertilizers in German agriculture, 1890-1912.*

	1890 — metric tons	1900 — metric tons	1910 — metric tons	1912 — metric tons	Value in millions of Marks
1. Bone meal	99 001	63 462	81 063	75 500	c. 6 ³ / ₄
2. Guano (artificial and natural)	45 888	37 450	40 200	40 200	» 5 ¹ / ₂
3. Superphosphate (incl. misures)	500 000	754 944	1 267 060	1 640 600	» 98
4. Basic slag.	400 000	878 917	1 428 633	1 800 000	» 81 ¹ / ₂
5. Nitrate of soda	247 815	352 785	542 137	630 250	» 130
6. Sulphate of ammonia	60 000	117 638	268 330	356 150	» 100
7. Various (cyanamide, nitrate of lime, dried blood, horn meal, etc.)	50 000	50 000	60 000	100 000	» 18
8. Potash salts (total).	219 553	833 472	2 219 037	2 700 000	» 71
(As crude potash salts) . .	—	(774 916)	(1 953 964)	(2 320 000)	—
Total (1)	1 622 257	3 088 669	5 906 530	7 352 700	c. 512

(1) Owing to lack of precise data, these figures are only approximate, except for potash.

Lime may be estimated at 800 000 to 1 000 000 metric tons, worth 12 to 14 million Marks; this sum may be set against the mixed manures (ammonia-super, etc.) included with superphosphate, so that the final total will not be materially altered.

The prices of the chief artificial manures have diminished considerably since 1870; this fall is to no small degree due to the competition of newer manures, such as sulphate of ammonia and basic slag. The wholesale prices have been about as follows:

	Unit of N in nitrate of soda	Unit of water- soluble P ₂ O ₅ in superphosphate
	s	s d
1870	25	9 6
1890	15	6 6
1912	14	3 5

Potash salts and limes show no distinct change over the last decade, but a slight rise has very recently set in. Kainit was at 18s a ton in 1880 and down to 15s in 1900, while 40 per cent. potash salts have been sold at about £3 4s per ton since 1890. Since the Potash Law came into force (beginning of July 1910) the crude salts with 12 to 15 per cent. of K₂O have been sold at 1s per unit (carnallit with 9 to 11 per cent. only 10d), while the prepared salts with 40 to 42 per cent. K₂O have made 1s 6¹/₂d per unit.

The Dairy Industry of Great Britain

by

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For the last twenty years the Dairy Industry in Great Britain has been steadily growing in importance, and dairy farming has to a large extent taken the place of other kinds of farming.

This may be accounted for by the increased consumption of milk by the populace, which has been and still is being educated to realise the high feeding value of milk, which has become more and more part of the national everyday diet of adults as well as children.

An estimate made some time ago put it that the annual increase in the consumption of milk amounted to some 5 000 000 gallons, but it is doubtful if such will continue the annual figure if the retail price of milk is unduly increased. But whilst people are learning more concerning the value of milk in their daily dietary, it is as yet difficult for the majority to realise that in proportion to its cost it is the cheapest food obtainable. Thus, whilst the price of most foods has gone up recently, that of milk also has been slightly increased. An increase in the price of milk, however, is generally resented by the public, which resentment is apt to show itself in the form of a decreased consumption. People would not, however, endeavour to effect economies in their living expenses by cutting down the quantity of milk purchased if they possessed a proper knowledge of the feeding value of this food in proportion to its cost. Undoubtedly no other food can be obtained in Great Britain at as cheap a rate, taking into consideration its food value.

Now of what value is the Dairy Industry of Great Britain at the present time? The answer is supplied in some figures recently published by the Statistical Department of the Board of Agriculture, by which it is shown that the estimated quantity of milk produced, after allowing for the amount used for calf-rearing, is 1 208 000 000 gallons per annum.

As to the manner in which this milk is dealt with, it is calculated that 70 per cent., or 850 000 000 gallons, is sold as milk, whilst the value of the dairy products respectively as sold by the farmers is :

£24 963 000	for milk
£ 590 000	“ cream
£ 2 940 000	“ butter
and £ 1 400 000	“ cheese.

These figures show very clearly the great value to the farming industry of the milk sold for consumption in the towns, whilst the total sum realised for the milk and its products is about the same as that realised for the wheat, barley and oats grown. Furthermore it nearly reaches the sum obtained for cattle sold as meat.

It would be interesting and instructive to compare these figures with similar estimates for say two decades back, but unfortunately this cannot be done, such returns not being available. What has happened, however, in recent years is that dairy farming has steadily been taking the place of corn growing, and arable land has been turned into pasture to suit the altered class of farming, thus resulting in an ever decreasing area of cultivated arable land.

Where corn growing has not been found to pay, dairy farming has generally been substituted, and it has also largely taken the place of fattening cattle—a class of farming which has not been very remunerative of recent years, owing to the large importation of foreign and colonial meat that has come into operation.

Now whilst the importation of butter and cheese from abroad largely influences the value of these commodities as produced in Great Britain, there is practically no importation of milk to affect the value of the new milk trade. The populace of Great Britain, whilst existing and being dependent chiefly on foods imported from abroad, is fortunately able to obtain a supply of home-produced milk to meet its requirements fully. Small quantities of fresh milk are imported from countries within easy reach of the British Isles, but the quantity is negligible and the trade at present shows no prospect of developing.

Milk selling has been described recently as the sheet anchor of the English farmer, and certainly it has assisted him to an extraordinary extent when other systems of farming have failed. He realises that he is free from the competition created by imports from abroad that exists in the case of most other commodities, and thus is able to develop his trade without the fear of having to compete with others who can produce milk at cheaper cost. The retail price in towns varies from 1s 2d to 1s 4d per gallon. In many large towns up to within about four years ago milk was sold at 1s per gallon all the year round, but it is now generally sold at 1s in summer and 1s 4d in winter, making an average price of 1s 2d, though in many of the large towns it does not vary from all 1s 4d the year round and 1s 8d per gallon is charged for the best class trade in London.

Generally speaking the wholesale price of milk throughout the country may be taken as about $7\frac{1}{2}$ d per gallon net to the farmer throughout the year after the freight charges have been deducted. About $8\frac{1}{2}$ d net is obtained in the winter and about $6\frac{1}{2}$ d net in the six summer months. The cost of transport in the country generally may be taken as 1d per gallon which conveys the milk up to 100 miles. Comparatively little milk travels short distances so as to secure the $\frac{1}{2}$ d per gallon rate which conveys it for 20 miles.

It is not the same with the butter and cheese trade, however, for these have to compete with imports from very many parts of the globe. The imports of butter into Great Britain are valued at £24 000 000, and those of cheese at £7 000 000, which totals more than the whole amount realised for milk, cream, butter and cheese produced in the country. The cost of production in most countries from which butter and cheese

are received is much less, owing to cheaper land, cattle, feeding, etc ; hence the development of the milk trade in Great Britain at the expense of the manufacture of cheese and butter, as shown in the figures previously quoted.

The question arises as to what is being done to cope with the increased demand for milk and the possibility of the demand being greater than the supply. As previously mentioned, more and more arable land is being converted into pasture, which is the main requirement for dairy farming ; but apart from this must be considered the number of stock capable of being carried by the total amount of land available. Farming in Great Britain is still regarded as one of the less important industries, though there are many movements on foot at the present time to make it more productive and to increase the area of land available for agricultural purposes, by bringing under cultivation soil which at present is more or less unproductive. If, however, these points are left out of consideration and it is assumed that the present available land is carrying practically all the stock it is capable of doing, which we think is by no means the case, there is still a means of increasing milk production. This is by means of increasing the yielding capacity of the dairy cows, or, in other words, devoting special attention to breeding and selecting animals for high yields of milk. A great deal of work is now being done in this direction both by individual dairy farmers and public bodies—work that ten years ago merited but little attention. If the average yield per cow, as is estimated for Great Britain, is only some 350 to 400 gallons, then it follows that much improvement is possible. Milk records are being carried out by various County Councils and Dairy Associations (1) the results of which show the quantity and quality of the milk yielded annually by each individual cow in the herd, and this information enables the farmer to retain only the cows which give satisfactory results.

In Scotland a number of Dairy Societies have been started and have been in operation some five or six years, with the result that Milk Record Schemes of great value have been obtained and much growth in this is being continued. It is found that in most herds the variation in the annual yield per cow is great, for whilst the poorest animal may give 350 gallons or less the best may be yielding 1 000 or perhaps more. Now the cost of keeping and tending an animal yielding a large quantity of milk does not much exceed that of a poor cow ; hence if only good cows of tested capacity are kept, as much as 50 per cent. more milk may be obtained from a similar number of cows.

Most dairy farmers, even men who have been engaged in the work for many years, seldom know the milk yield of each cow in their herds, and milk records have shown as wide a difference between two herds on adjoining farms as 200 gallons per cow. Thus the farmer whose herd averages 600 gallons per cow per annum, may look forward by exercising care in selecting his cattle to increasing the yield to 800 in the course of a few years.

(1) Sec No. 1439, B, Oct. 1912.

(Ed.).

Numerous dairy farmers, however, do not breed their own stock, but instead buy cows which they retain for one, two or three years and then sell them off fat to the butcher. The calves of such animals are usually also sold to the butcher, and this system of dairy farming tends to reduce the quantity of milking stock in the country and many of the best dairy cows are thus lost. Such may be considered a very extravagant method of dairy farming, and to the farmer in this case milk records do not appeal, as he does not keep his cows a sufficient length of time and does not retain any of the progeny, even of the best ones.

The favourite breed of Dairy cattle throughout the country is the Dairy Shorthorn — an animal of Shorthorn type but not of pedigree strain. A good animal of this class may be valued at from £18 to £25.

The factory system of dairying is not extensively carried on in Great Britain, but in Ireland there are a very large number of Creameries, and butter-making on Danish methods is practised. In England the large centres of population require the milk for consumption, but in Ireland there are but few large towns and their requirements of new milk are limited, allowing for an extensive manufacture of butter. Where factories exist in Great Britain they usually engage in all branches of the dairy industry, selling milk to the towns whenever possible and making cheese and butter. The former generally gives better returns than converting the milk into dairy products, hence the manufacturing periods are chiefly when milk is plentiful and the markets overloaded. Of course in many cases there are factories where cheese or butter is manufactured and milk selling not undertaken, but these are becoming fewer and exist chiefly in the more isolated districts. The greater part of the butter and cheese produced is still made on the farms, but even this is rapidly changing and where farmers formerly manufactured the milk at home they are commencing the sale of the milk.

A number of factories on co-operative lines are being established. Such factories, started and run by the farmers themselves, are proving a very satisfactory means of regulating the milk trade, as when there is a surplus of milk it need not be placed on the market and so lower prices, but can be converted into cheese and butter. Further, where the milk is manufactured at a factory it is possible to produce an article of more uniform quality than is the case at individual farms, and the smaller dairy farmers are thus enabled to obtain a better return for the milk produced on their holdings.

Whilst it is still a fact that the finest quality butter and cheese is produced at the best farms, it is nevertheless true that the bulk compares very unfavourably in quality with that turned out from the factory where skilled labour and scientific methods are in vogue. Much expenditure has been made in teaching butter and cheese-making for many years past, and doubtless some general improvement in farm-made dairy products has resulted, but on the whole the return has been small in proportion to the expenditure involved. It has indeed become generally recognised that it is better for a group of farmers to start a dairy together, properly equip it and employ the best skilled labour rather than continue the manu-

facture of dairy products at home. Better means of marketing are possible and generally better financial returns are the result.

For the protection of the public, various laws affecting the production and sale of milk have been put into operation recently and further restrictions on the sale of milk will come into force when what is known as Mr. Burns' Milk Bill at present before Parliament becomes law. Parliament, after many years of apathy, has become alive to the needs that the nation has of supplies of pure wholesome milk. It doubtless realises that the health of the nation depends greatly upon supplies of pure milk, especially as milk has now become so commonly used in the daily dietary of the great majority, and moreover it is the chief food of children who need most protection.

Following upon the reports of the Royal Commission on Tuberculosis, whose investigations and findings during the last twenty years have shown that tuberculosis or consumption in human beings is largely caused by tuberculous milk and meat, an order came into force on May 1st by which all tuberculous cattle must be notified. Such cattle are to be examined by Veterinary Inspectors appointed by the County Councils, and on their recommendation all obviously tuberculous animals and cows suffering from tuberculous udders will be slaughtered, compensation to the extent of one quarter of the estimated value of the animal being paid to the farmer where advanced tuberculosis is discovered. Where tuberculosis is manifest but not advanced three quarters of the value will be paid—in each case half the cost of the valuation and examination to be deducted.

This is an important move in protecting the public, especially children, from tuberculous milk and meat, as unfortunately a fairly large percentage of tuberculous milk is now marketed; indeed some recent figures of extensive analyses made of London's milk supply showed no less than 10 per cent. of the supply as containing the tubercle bacilli. Municipal authorities can exercise powers to prevent the entrance of milk in towns from any source when it is proven to be tuberculous, but such powers are seldom used. Whilst the Tuberculosis Order will doubtless in a few years result in the killing off of most badly tuberculous cattle, there will still remain the animals that are apparently healthy but are really tuberculous as shown by the tuberculin test. In several instances private enterprise has embarked upon the supply of milk solely from cows which have passed the tuberculin test and are kept periodically tested, which is the only sure way of obtaining a milk supply guaranteed free from tubercle germs.

This alone is not the only part of the scheme, as if milk is obtained pure from healthy cows it must not be allowed to get contaminated from human infection afterwards and before it reaches the consumer, and to prevent this it must be handled and distributed under proper hygienic conditions. There is a minimum Government standard of quality which specifies that if milk contains less than 3 per cent. of fat and 8.5 per cent. of solids-not-fat it is presumed, until the contrary is proved, that the milk is adulterated.

The law also prohibits the use of any chemical preservative whatever in milk, though harmless colouring matter is not debarred. Recently too the use of preservatives in cream has been restricted and it is now illegal to add any preservative whatever to cream containing less than 40 per cent. of fat. If cream containing over 40 per cent. fat is preserved, only borax, boric acid, and hydrogen peroxide are permitted to be used, and all receptacles in which such preserved cream is sold must have affixed to them a label printed in letters of a specified size varying with the size of the vessel, stating the preservative used, and if borax or boric acid or both be present, the percentage expressed in terms of boric acid must be stated on the labels. Restaurants and Refreshment Rooms serving preserved cream are required to display notices to this effect.

Appendix.

TABLE I. — *Number of churns of milk delivered daily at London railway stations by the various railway companies in 1907.*

	No.
Great Western Railway	3 999
London and South-Western Railway	2 477
London and North-Western Railway	1 670
Great Northern Railway	1 153
Midland Railway	1 094
Great Eastern Railway	952
London, Brighton & South Coast Railway	941
South-Eastern & Chatham Railway	377
Great Central Railway	175
North London Railway	122
Metropolitan Railway	50
West London Extension	16
Total	13 026 churns
	or 13 026 X 17
	= 221 442 gallons

Approximately therefore the amount of milk reaching London daily by rails is 221 442 gallons and the quantity brought to London by road or produced in London is small.

The North-Eastern Railway Company has kindly supplied the following figures for the imports of milk into Newcastle during 1911: estimated number of gallons 1 952 502. As this City has a population of 266 603 this means roughly 7.3 gallons per head, but it should be taken into consideration that the milk arriving by rail is by no means all the milk received in Newcastle, as a large number of farmers in the district convey to and retail milk in the City.

TABLE II.—*Quantity and value of cheese exported to each country from the United Kingdom in the year 1912.*

Countries to which consigned	British and Irish Produce		Foreign and Colonial Produce	
	Cwts	£	Cwts	£
Russia	149	704	*	—
Germany	604	2 785	905	3 235
France	475	2 137	1 255	4 662
Spain	134	595	*	—
Egypt	118	540	960	3 438
United States of America	592	5 291	141	420
Chile	186	864	*	—
Brazil	277	1 255	12 426	49 100
Netherlands	*	—	320	973
Belgium	*	—	2 359	8 363
Portugal	*	—	5 037	20 820
Italy	*	—	883	2 754
Philippine Islands and Guam	*	—	2 049	7 422
Cuba	*	—	204	673
Other foreign countries	1 061	5 286	3 547	12 802
Total to foreign countries	3 596	19 457	30 086	114 662
Channel Islands	322	1 216	2 988	9 720
Cape of Good Hope	334	1 511	13 017	40 152
Natal	146	710	5 983	18 231
British India	2 181	10 126	1 880	8 313
Australia	115	740	**	—
British West Indies	314	1 564	**	—
Gibraltar	**	—	2 053	7 321
Malta and Gozo	**	—	2 651	9 307
Transvaal	**	—	8 021	25 978
Other British Possessions	1 534	7 547	2 618	10 971
Total to British Possessions	4 946	23 324	39 211	130 513
Total	8 542	42 781	69 297	245 175

* Included (if any) in other foreign countries.

** Included (if any) in other British Possessions.

TABLE III. — *Quantity and value of butter and cheese imported into the United Kingdom from each country in the year 1912.*

Countries from which consigned	Butter		Cheese	
	Cwts.	£	Cwts.	£
Russia	683 650	5 656 742	*	—
Sweden	335 014	2 113 871	*	—
Norway	30 634	192 183	*	—
Denmark (inc. Farøe Islands)	1 618 048	10 356 001	*	—
Iceland and Greenland . . .	3 973	21 264	*	—
Germany	2 355	12 221	*	—
Netherlands	113 716	641 638	268 286	701 696
France	246 652	1 559 452	16 030	56 852
Italy	1 534	8 560	91 060	306 287
United States of America . .	2 596	15 250	21 227	66 565
Argentine Republic	67 244	396 964	*	—
Belgium	*	—	442	1 429
Switzerland	*	—	12 226	41 200
Other foreign countries . .	119	657	1 579	4 478
Total from foreign countries	3 105 535	18 974 803	410 890	1 178 507
British India	924	3 559	**	—
Australia	549 396	3 225 886	1 408	4 903
New Zealand	349 012	2 148 192	543 917	1 882 840
Canada	27	145	1 452 570	4 347 832
Other British Possessions . .	265	1 608	2	9
Total from British Possessions	899 624	5 379 390	1 897 897	6 235 584
Total	4 005 159	24 354 193	2 308 787	7 414 091

* Included (if any) in other foreign countries.

** Included (if any) in other British Possessions.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

698 - **Legislation for the Protection of Moors in Germany.** — *Landwirtschaftliches Wochenblatt für Schleswig-Holstein, amtliches Organ der Landwirtschaftskammer*, Year 64, No. 18, pp. 405-406. Kiel, May 1, 1914.

LEGISLATIVE
AND ADMINI-
STRATIVE
MEASURES

The law of March 4, 1913, for the protection of moors in the province of Hanover has been extended (April 1, 1914) to the provinces of Pomerania and Schleswig-Holstein.

The object of the law is to prevent the uneconomical exploitation of the moors. It prescribes that plots of land which alone or with others form a compact area of moor more than 25 ha. (62 acres) in extent, so far as public interest requires it, can only be worked for peat in such a way as to ensure their further profitable use for agriculture or forestry.

The use of such plots for cutting out of peat requires the authorization of the district committee, for which an application has to be made. Before granting the authorization a competent office to be nominated by the Minister of Agriculture, Domains and Forests has to be consulted, as well as the Improvements' officials. If requested, an expert named by the applicant has also to be heard. Against the decision of the district committee the applicant may appeal within two weeks to the Minister of Agriculture. Undertakings which had already begun cutting out peat before the law had come into force may continue to work for six months longer without being subject to the limitations of the new law.

The authorization to cut out peat is not required when the peat is used in the household or farm of the owner, farmer, or person entitled to excavate peat or of an agricultural labourer under permanent engagement to the owner of the peat bed, when his agreement authorises him to cut peat for his own household or farm. Further the authorization is not required when the peat is cut for sale, provided such cutting be conducted by not

more than six persons and without machinery. The district police, however, may issue regulations with regard to peat cutting in order to safeguard the interests of agriculture or forestry.

ORGANIZATION
OF EXPERI-
MENTAL AND
ANALYTICAL
WORK.

699 - **Experiments with Plots of Different Sizes (1).** — SCHNEIDEWIND, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 29, Part 21, pp. 298-300. Berlin, May 23, 1914.

Experiments have been undertaken at the experimental farm at Lauchstädt, with the object of comparing the yield from different sized and differently arranged plots, and the influence of manuring on the respective yields. The plots have been laid out on a very uniform piece of land, and the experiments, which are to be continued for a considerable time, are arranged as follows.

I. 30 plots of 9 sq. metres ($10 \frac{3}{4}$ sq. yds.) each, adjoining one another without intervals.

II. 20 plots of 9 sq. metres each, in the form of a square with an unplanted margin 80 cm. (31 in.) wide all round.

III. 18 plots of 100 sq. m. (120 sq. yds.) each adjoining one another, without intervals, and without any unplanted borders.

IV. 6 plots of 200 sq. m. (240 sq. yds.) each, but otherwise resembling Group III.

In 1913 sugar-beets were sown on the plots. One row of plots in each of the four groups received 1.6 cwt. and one row 3.2 cwt. of nitrate of soda per acre, while the third received no nitrogenous manure.

The returns are only complete for Groups I, II and IV. The yield of the plots with borders round them (Group II) was, in the "unmanured" cases, superior to that of Groups I and IV (without borders) by about 4 tons an acre of fresh roots.

The nitrogenous manure had less effect on the plots with borders, where more nitrogen and moisture were available for the plants on account of the free space, than on the other areas: while 3.2 cwt. of nitrate of soda per acre produced on the Group I plots an increase of about 2 tons of roots an acre, and on those of Group IV an increase of about 37 cwt., a similar dressing only gave an increase of 23 cwt. on the plots with borders. The results obtained from the 1.6 cwt. per acre dressing of nitrate of soda do not agree satisfactorily with the above.

700 - **The Work of the Buitenzorg Botanic Gardens for 1913.** — DE JONG, A. W. K. in *Mededeelingen van het agricultuurchemisch laboratorium*, No. VII, pp. 1-49. Batavia, 1914.

The experiments carried out at the Botanic Gardens in Buitenzorg during 1913 led to the following conclusions.

1. Earthnuts ploughed in green not only increase the following rice crop but also the next earthnut crop taken after the rice.

2. The largest increase with manioc was obtained when complete manures were used, but nitrogenous manures alone were almost as efficient.

(1) See No. 795, B. July 1913.

(Ed.).

3. No increase was obtained in crops of sweet potato, lemon-grass and earthnut when dung was added to potassic fertilizers.

4. Earthnuts grown continuously on the same field appear to become more resistant; the number of dead plants gradually diminishes.

701 - **Formation of an Agricultural Office for Tripoli.** — *Bollettino di Informazioni dell'Ufficio Economico del Ministero delle Colonie*, Year II, No. 4, pp. 271-273. Rome, April 1914.

AGRICULTURAL
INSTITUTIONS.

The Royal Decree of March, 1914, instituted an Agricultural Office in Tripoli for the purpose of carrying out experiments of a technical and economic nature in that country and to study the means of encouraging the native agriculture and colonisation. The office comprises:

- a) an experimental section, technical and economic;
- b) an administrative section;
- c) a section including the meteorological, engineering, statistical and other departments necessary for the development of the Office.

The staff of the Office may be chosen from amongst Civil Servants or from private individuals possessing the required qualifications and will be made up as follows:

	No.
Director	1
Heads of the administrative and technical departments	2
Technical experts	4
Secretary	1
Laboratory assistants	1
Field men	4
Labourer	1
Porter	1

In accordance with the suggestion made by the Commission appointed to investigate the agricultural conditions of Tripoli, the Minister of the Colonies has decided to let experimentation precede demonstration and the giving of advice, with regard to both technical and economic questions. The first director to be appointed to the office is Prof. DE CILLIS, from the Royal Agricultural College at Portici, Naples, and he will also form part of the Government Commission for investigating the agricultural conditions of Tripoli.

702 - **Agricultural Shows.**

United States.

1914 Oct. 7-17. Wichita (Kansas). — International Soil-Products Exposition, held on the occasion of the Ninth International Dry-Farming Congress.

AGRICULTURAL
SHOWS AND
CONGRESSES

703 - **Agricultural Congresses.**

Italy.

1914 Sept. 24-29. Milan. — Third National Congress of Applied Chemistry. Dr. Vicentini, Via Marsala 8, Milan.

United States.

1914 Oct. 7-17. Wichita (Kansas). — Ninth International Dry-Farming Congress. Secretary: Ralph H. Faxon, Wichita, Kansas.

CROPS AND CULTIVATION.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

- 704 - Separation of Soil Particles according to their Specific Gravity, and the Relations between Plants and Soils. — KÖNIG, J. (Report from the Agricultural Experiment Station at Münster-in-Westphalia), in *Landwirtschaftlicher Jahrbücher*, Vol. XLVI, Part 2, pp. 165-251. Berlin, 1914.

I. *Separation of Soil Particles according to their Specific Gravity.*

The writers have separated out the constituents of seven soils by means of liquids of different specific gravities; the liquid used was a mixture of bromoform and benzol, which may be considered as without action on soils. The separation was carried out at first by shaking followed by settling till the liquid was clear, the floating particles remaining at the surface and the remainder at the bottom; subsequently an improvement was made by centrifuging the liquid for 10 minutes instead of allowing it to stand. Altogether four of the mixed liquids were used, with S. G. 2.36, 2.49, 2.55 and 2.64, giving five soil fractions. Two of the soils (one clay and the other schistose) could not be separated by shaking and settling, in the case of the schistose soil owing to the constituents being practically uniform; it was also found that organic material adhered to the heavier particles and could not be separated even by continued shaking. With the help of the centrifuge the separation was better, and even the clay and schistose soils could be dealt with.

Physical and chemical examination of the five fractions led to the following general conclusions:

1. The facility or otherwise of the separation is an indication of the heterogeneity or homogeneity of the soil. The clay gave none of the two heaviest fractions (I and II) even on centrifuging, while the lightest (fraction V) amounted to only 1.08 per cent. Of other soils, those containing plenty of humus and colloids give considerable amounts of the lighter fractions, whilst preponderance of the heavier fractions indicates a soil lacking in humus and therefore of low fertility.

2. Fraction I (S. G. more than 2.64) is almost lacking in clays; in the sand, the loamy sand, the loam and the calcareous soil it does not exceed 1 per cent., while in the schistose soil it reaches 7.3 per cent. It consists largely of silicate fragments.

3. Fraction V (S. G. less than 2.36) contains large quantities of organic matter, as well as the bulk of the colloids and nutritive substances of use to plants.

4. It should be noted that fraction V (or in general the fractions containing most nutritive material) also contains the largest amount of silicic acid, iron oxide and alumina, *i.e.* colloids; the humus is so intimately connected with these minerals that it cannot be separated from them mechanically. This tends to support the view arrived at in previous work that the humus in the soil is present, at any rate in part, in the form of complex humate-silicates.

5. Comparison of the five fractions shows that in all four soils examined in detail (sandy garden soil, calcareous soil, loam and sand) there is an almost regular rise in the relative amount of nutritive material from I to V or at any rate from II to V.

8. The distribution of clay (*i.e.* the portion of the soil freed by sulphuric acid) in the different fractions varies with the type of soil.

II. The Relations between Plants and Soils.

Culture experiments have been in progress since 1904 in connection with the work on the investigation of the soil (1), especially with a view to determining the relation between the amount of dry matter produced and such properties of the soil as catalytic energy, nutritive material freed by oxidation, or by steaming under pressure, osmotic pressure, colloid content and oxidizing power. Six types of soil (sand, schistose soil, clay, loam, calcareous soil, and sandy loam) were used, and the experiments were made both in the open and in pots under glass.

During these investigations the following points were elucidated:

1. The plants grown in pots under glass generally gave higher yields for a given area than those growing in the open, but the difference in the experiments was not so great as in many conducted elsewhere.

2. In hot dry summers, the absorption of minerals, particularly phosphoric acid, may be much greater than in cool rainy ones, but this is not necessarily associated with increased production of dry matter. The increased absorption of phosphoric acid in hot dry weather is no doubt due to increased oxidation, and consequently increased solubilisation, of the phosphoric acid in organic combination, owing to increased penetration of air into the soil.

3. The relations between the principal nutritive elements absorbed and the dry matter produced are shown in the accompanying table:

Conditions of experiments	Parts of dry matter produced for 1 part of:					
	Nitrogen		Phosphoric acid		Potash	
	Limits	Average	Limits	Average	Limits	Average
10-year average for six soils { under glass	59-65	62	—	177	38-86	69
	57-62	59	137-176	161	36-57	48
In the very good garden soil	31-67	49	79-153	109	30-83	47
Previous experiments under various conditions	30-82	57	92-272	169	29-94	61

For lime, the ten-year averages gave figures ranging from 61 to 100, average 83. It appears that the following values may be used for determin-

(1) Published in *Landw. Versuchs-Stationen*, 1907 to 1913.

ing the necessity of manuring for any particular soil (using averages of the various crops) :

	Relative dry-matter value:	
	Minimum below which manure is not required	Maximum above which manure is required
Nitrogen	50	62
Phosphoric acid.	100	170
Potash	47	60

Individual crops show marked deviations, as shown by the following values for potash :

Cereals.	73
Potatoes.	38
Red clover	37
Mangels	29

For lime, red clover gives a value of 31, while the average of the other field crops is 126.

4. The general relations of the four nutritive materials to one another in the dry matter of plants are :

$$\text{N} \quad \text{P}_2\text{O}_5 \quad \text{K}_2\text{O} \quad \text{CaO} \\ 100 : 35 - 40 : 130 - 140 : 75 - 80$$

Here again there are deviations for individual crops, in particular Leguminosae ; thus the P_2O_5 per 100N is only 19 for red clover against 44 for the other crops and 56 for mangels.

5. The sum of potash + lime is fairly constant, being 3.0 to 3.5 per cent. of the total dry matter.

6. Unbalanced manuring with potash and phosphates, in soil not requiring these elements, and especially in time of drought, may reduce the amount of dry matter produced.

7. In all the soils except the sandy loam, very good correlation has been established between the amount of dry matter produced by the plants and the following chemical or physical properties of the soil :

- amount of ammonia absorbed (Knop) ;
- amount of potash and phosphates absorbed (M. Fesca) ;
- hygroscopicity (A. Mitscherlich) ;
- absorption figure for methyl-violet ;
- osmotic absorption of water ;
- electrolytic conductivity (the last three in the Münster investigations).

8. The best method for determining the amount of potash available for plants is steaming the soil for 5 hours under a pressure of 5 atmospheres. In the individual experiments as well as in the 10-year average the amount of soluble potash down to a depth of 6 to 8 in. determined in this way was very near the amount taken up by the plants.

It may be concluded that soils giving only 5 mgms. of potash soluble in this way per 100 gms. of soil require potash manuring, while soils

containing more than 8 mgms. do not require it. Here again, of course, individual crops vary, beets and clover taking more than the amount considered "available".

9. The "available" phosphoric acid determined by various methods does not show any close agreement with the amount taken up by plants: it appears that the higher the content of the soil in lime, magnesia, iron oxide and alumina, the more difficult is the absorption of phosphoric acid. Weather and plant-species are also of importance. At the same time it may be said that soils giving less than 4 mgms. of phosphoric acid per 100 gms. of soil by the steaming method, require phosphatic dressings.

10. For nitrogen and lime no definite relation between the absolute quantity in the soil and the quantity absorbed by plants has been determined.

11. Application of either the electrolytic conductivity or the steaming under pressure method before and after the culture period is useful for determining the amount of nutritive material removed from the soil by the plant. In these experiments, the amount of phosphoric acid taken up ranged from 23 to 34 per cent. (average 29 per cent.) of that in a soluble condition after steaming.

795 — **Rocks and Soils in their Relation to the Nutrition of Plants.** — BLANCE, E. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIV, Part V and VI, pp. 399-425. Berlin, 1914.

The writer has carried out vegetation experiments with eruptive rocks and crystalline schists having the following percentage composition:

	Quartzite schist	Porphyry	Granite		
			1	2	3
Si O ₂	92.611	76.552	73.499	73.752	74.399
Al ₂ O ₃	5.093	12.145	14.565	13.838	14.065
Fe ₂ O ₃	0.520	1.720	3.086	3.566	2.166
Ca O	0.287	0.893	1.733	1.866	1.267
Mg O	0.607	0.673	0.386	0.720	0.833
K ₂ O	—	4.806	3.466	3.900	4.660
Na ₂ O	—	2.346	3.946	3.733	3.380
P ₂ O ₅	traces	distinct traces	distinct traces	distinct traces	distinct traces
Loss on ignition.	0.840	1.540	0.466	0.360	0.567
	99.938	100.675	101.147	101.735	101.337

The material used in the experiments consisted of unweathered rubble as it comes from the quarry. It was then crushed so that it resembled more or less fine-grained groats and in this form it was placed in the culture pots. As experiment plants, oats and peas were used. No manure was

given, except 0.1 gm. of ammonium sulphate for the oats. The peas received a solution of soil in which peas had grown, so as to inoculate the nodule bacteria. Thus the action of any artificial manure on the components of the rocks may be said to be practically non-existent.

The results of the experiments are summarized as follows by the writer :

1. The four igneous rocks examined, namely three granites and a porphyry, proved superior to the quartzite schist in the crop of oats and peas, but the plant food contained in the quartzite schist was much better utilized than that contained in the igneous rocks.

2. These experiments have demonstrated that mica-potash, especially biotite-potash, is much more accessible to plants than the potash of feldspar.

3. Sandstones, according to previous experiments made by the writer, are much more suitable for the growth of plants, both for the amount of yield and for the utilization of the plant food, than quartzite schist, granite or porphyry.

706 - **A Further Case of Soil Sterility in the Dutch East Indies.** — LEDEBOER, F. and BERKHOUT, A. E. in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, Year XXII, No. 18, pp. 653-672. Surabaya, May 1914.

Soil sterility due to the presence of excessive quantities of chlorides and sulphates is a well-known phenomenon in the Dutch East Indies; such salts are probably derived from flooded craters; but a case of sterility has recently been investigated from the Pemalang district which revealed the presence of large quantities of soda mostly in the form of carbonate; the percentage being much higher than that given by O. MAIOR (1) for sodic soils at Sipote (Jassy). This large quantity of soda accounts for the curious character of the Java soil: when it rains the soda forms adsorption compounds with the soil colloids, thus producing hydrogels, then dries out very slowly, undergoing such a large decrease in volume that cracks appear at the surface.

Manurial experiments have already proved that the addition of 1.2 per cent. of quicklime produces a wonderful improvement, while the addition of 3.6 per cent. injures the vegetation but completely changes the structure of the soil, as the lime displaces the soda in the colloidal compounds and causes flocculation. Gypsum employed in similar cases in America and India gave even better results, as the sulphuric acid formed neutralizes the alkali which is injurious to plant roots.

Analyses of subsoil water revealed a content of 492 mgm. of sodium carbonate per litre, showing that the soda comes from the subsoil.

707 - **Relations of Certain Higher Plants to the Formation of Nitrates in Soils.** — LYON, T. LYTTLETON and BIZZELL, JAMES A. in *Cornell University Agricultural Experiment Station, Memoir No. 1*, pp. 9-109. Ithaca, N. Y., 1913.

The relation of timothy grass to the nitrogen content of the soil has been studied for six years at the Experiment Station at Cornell University.

(1) Die Salzböden Rumäniens, *Kühn Archiv*, Vol. I, p. 426.

During 1907, 1908 and 1909 nitrate determinations were made of samples of soil taken from field plats under timothy, maize and oats in rotation. The results obtained were no doubt considerably influenced by the heavy clay soil, which made the movements of nitrates very slow and hence emphasized the relationship between the plant at any particular stage of growth and the nitrate content of the soil.

Each plat was divided into sections, of which one was always kept bare but received the same soil treatment as the planted sections of the plat, thus permitting a constant comparison of the nitrates in the planted and the unplanted sections.

It was found that : 1) The nitrate content of soil under timothy, maize, potatoes, oats, millet and soy beans was different for each crop when on the same soil and there was a characteristic relationship between the crop and the nitrate content of the soil at different stages of growth.

2) During the most active growing period of the maize crop, nitrates were frequently higher under maize than in cultivated soil bearing no crop, and under a mixture of maize and millet, nitrates at this period were higher than under millet alone, although the crop yields were about the same on both plats.

3) Under both maize and oats the nitrate content was higher during the period when the crop was making its greatest draft on the soil nitrogen than in the later stages of growth, but under these crops and under millet there was no increase in nitrates late in the season when nitrogen absorption had practically ceased, although uncropped soil showed a very large increase in nitrates at that time.

4) Changes in the moisture content or in the temperature of the soil after early summer had no important effect on the nitrate content of the soil under crops.

These phenomena may be accounted for on the assumption that nitrate formation is stimulated by some processes connected with the active growth and absorbing functions of some higher plants, particularly of maize. This, together with the fact that the maize plant probably obtains a large part of its nitrogen in some form other than as nitrates, would account for the very high nitrate content of the soil under maize. The differences in the production of nitrates below different crops would be accounted for by supposing differences in the stimulating or inhibiting influences on nitrification, as well as in the relative rates, amounts and forms of nitrogen absorption.

The nitrifying power of the soil under different conditions of cultivation was determined by incubation with dried blood.

It was found that : 1) The rate of nitrification of alfalfa soil was greater than that of timothy soil ; this effect was maintained for two years after removal of the crop.

2) There is a distinct relation between the nitrifying power of a soil and the nature of the crop previously grown.

3) Nitrates were most abundant after a maize crop, the next highest being after a potato crop and the least after oats.

4) Freezing and thawing renders the soil more favourable to nitrate formation, but it is not known if this effect is due to the cold readjusting the equilibrium of the bacterial flora, or overcoming the depressing influence of some previous crop.

5) Timothy grass maintains a lower nitrate content in the soil than any other crop, and mixed grasses gave much less nitrogen in the crop and drainage water combined than was found in the drainage water from unplanted soil. This would suggest a possible explanation of the injurious effect of grass sod in orchards in which the supply of nitrogen is deficient. The influence of a crop on nitrification may be an important factor in crop rotation also.

708 - Chemical Composition of Moor Hay provoking Excessive Licking in Cattle.

— Communication from HJALMAR VON FEILITZEN, Director of the Experiment Station of the Swedish Moor Cultivation Union.

A former field agent of the Swedish Moor Cultivation Union reported that hay from a meadow sown down on fen land had proved injurious as winter fodder for cows: they lost their appetite and fell off in condition, some even having to be slaughtered.

An investigation of the fen in question was made by the Station. The first cut had given 2 tons of hay per acre, although the farmer had given it only a light dressing of manure: 1 $\frac{1}{4}$ cwt. per acre each of super and 38 per cent. potash salts. Samples were taken from the injurious part of the 1912 hay, as well as from a fen hay and a mineral-soil hay of the 1913 crop; unfortunately no 1912 hay from a mineral soil could be had.

A botanical examination showed no marked differences: all three samples consisted of nearly pure timothy (97.6t o 97.8 per cent.), with a little smooth-stalked meadow grass, red fescue, fiorin (*Agrostis*) and foxtail; the hay from the mineral soil contained some red and alsike clover (2 per cent.). The fen hay contained one or two pieces of *Potentilla erecta*, *Rubus saxatilis* and *Spiraea Ulmaria*. The only marked feature of the fen hay was the presence of a few brown tips to the leaves.

A thorough chemical analysis was made, comprising determination of fat, crude fibre, crude, pure and digestible protein, lecithin, ash constituents (iron oxide, alumina, lime, magnesia, potash, sodium, phosphoric acid, sulphuric acid — also sulphur in organic combination — and chlorine); but no defect was found in the fen hay. Naturally the total ash was higher in the hay from mineral soil; the fat content was also somewhat higher; fibre was rather more in the fen hay, no doubt owing to later cutting. Protein was highest in the 1912 fen hay, rather lower in the 1913 sample; digestible protein was also highest in the 1912 sample provoking "Lecksucht" (excessive desire to lick); indeed the feeding value shown by analysis was better in this than in the hay from mineral soil.

Of the individual ash constituents, potash was lower in the fen hay than in the mineral-soil hay; a heavier dressing of potash would have been advisable, but that insufficient manuring cannot have caused the toxicity is shown by the fact that the normal 1913 fen hay contained even less potash than the 1912 sample. The "Lecksucht" hay contained considerably

more sodium than either of the other samples, but this cannot be considered a disadvantage since it is usual to add salt to the rations. The phosphoric acid was very low in all three samples (in hay with 15 per cent. moisture, 0.295, 0.177 and 0.293 per cent., as compared with 0.35 to 0.40 per cent. in normal Swedish hay samples), so that this cannot have been the cause; the phosphorus in organic combination as lecithin and other phosphatides is also very low (0.014 and 0.012 per cent. P in the fen hays, and 0.020 in the mineral-soil hay), but here again the slight differences are of no significance on such small quantities. Of the other constituents, only chlorine is rather high in the "Lecksucht" hay (1.05 per cent. against 0.42 and 0.50), but this of course goes with the high sodium content.

Comparative chemical analysis therefore shows no reason for the injurious properties shown by this particular fen hay.

709 - **Tillage Experiments in Algeria** (1). — *Bulletin de l'Office du Gouvernement Général de l'Algérie*, Year XX, No. 11, pp. 178-179. Paris, June 1, 1914.

TILLAGE AND
METHODS OF
CULTIVATION

Tillage experiments were carried out at the Agricultural School of Maison Carrée in 1913, and it would appear from the results that no advantage was gained by subsoiling the land the previous autumn; in fact, in many cases the crops of hard wheat obtained on the subsoiled plots were inferior to those on the control plots.

710 - **Trials of the Zehetmayr Method of Drilling Cereals carried out in Sweden** (2). — RHODIN, SEGRD in *K. Landbruksakademiens Handlingar och Tidskrift*, Year LIII, No. 2, pp. 94-105. Stockholm, 1914.

The Zehetmayr method of drilling consists in planting the seed at the bottom of small furrows which serve as a protection during the winter and are flattened out in the spring by means of a special harrow. Trials of this method at the Central Agricultural Institute in Sweden did not give the good results expected; in fact in many cases the yield was lowered where this method was adopted. The failure is probably due to the mechanical condition of the rather heavy soil, a fine tilth and free working soil being necessary in order that the drill should work satisfactorily.

711 - **The Influence of Lime as Quicklime and Carbonate on the Physical Condition of Various Soils.** — ENGELS, O. (Speyer Agric. Exp. Station) in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIII, Part 5 and 6, pp. 409-466. Berlin, 1914.

MANURES AND
MANURING

Experiments have been carried out as to the effect of lime in a number of types of soils: in each case soil treated with 1 per cent. of quicklime was compared with that receiving 1 per cent. of calcium carbonate and with untreated soil.

Measurements were made of the various physical properties. In general quicklime had a more marked action than the carbonate; the increase in water capacity, permeability, hygroscopicity and friability and the decrease in contraction on drying were greater in soils containing more clay, whereas the decrease in capillarity due to liming was greater in the sandy soils.

(1) See also No. 1707, *B.* June 1911; No. 2098, *B.* July 1911.

(Ed.)

(2) See No. 1272, *B.* April 1911; No. 403, *B.* April 1913.

(Ed.)

712 - Influence of Straw on the Utilization of the Organic Nitrogen of Manures.

— VON MAY, F. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. II, Part 3, pp. 433-454. Vienna, May 15, 1914.

On the effect of straw as a manure there are a great number of papers in agricultural literature. In most cases experiments on the subject have shown that manuring with straw is followed by a diminution of the crop, after which some increase may be observed in the succeeding year. Most of these experiments have been carried out in pots or on very small plots in the open. The writer has sought as far as possible to carry out his experiments under field conditions.

The two experiments here reported upon dealt with the behaviour of the plants immediately after being manured; their results are summarized by the writer as follows: The utilization of a given quantity of organic nitrogen by plants grown immediately after an application of manure suffers a depression when a substance lacking nitrogen (in this case straw) is added. The magnitude of this depression depends principally upon the ratio between the available nitrogen and the nitrogen-free organic matter, which in its turn depends upon the ratio between the composition of the manure and the quantity of nitrogen in the soil. The more this ratio varies in favour of the nitrogen-free matter the greater the depression, and under the same circumstances those plants which require their nitrogen in the shortest time suffer most. The cause of this fact is attributed to the withdrawal of soluble nitrogen by the micro-organisms of the soil, which avail themselves of the nitrogen-free organic matter as a source of energy.

713 - On the Action of Sulphate of Ammonia and Superphosphate of Ammonia in Calcareous Soils.

— WLODECK, J. (Institute of Agriculture of the Jagielli University, Cracow) in *Odbitka z czasopisma Kosmos zeszyt 10-12 z. 7*, (Article in German). Lemberg, 1913.

Two field experiments were made on calcareous and sandy soils at the Experiment Farm of the Jagielli University, of Cracow, to determine the losses of nitrogen in manuring with sulphate of ammonia and to test the effect of superphosphate of ammonia in calcareous soils. The plants used in the experiments were cereals.

When the crops obtained in these experiments on calcareous and sandy soils are compared with those obtained by the use of nitrate of soda taken as 100, the following ratios are obtained:

	Calcareous soil	Sandy soil
Nitrate of soda	100.00	100.00
Superphosphate of ammonia	91.33	91.33
Sulphate of ammonia	76.49	99.85
Without nitrogen	70.50	78.85

The action of superphosphate of ammonia was thus the same in the two kinds of soil, while that of sulphate of ammonia was lower in the calcareous soil than in the sandy one. The writer comes to the conclusion that when conditions are very favourable to the volatilization of ammonia losses up to 20 per cent. occur, and that these losses can be avoided or considerably reduced by using superphosphate of ammonia.

714 - **The Utilization of Peat in Italy.** — Summary of a Lecture by Prof. UGO ROSSI given at a meeting of the Association of Italian Agriculturists, April 20, 1914. — *Società degli Agricoltori Italiani, Bollettino quindicinale*, Year XIX, No. 10, pp. 356-361. Rome, May 31, 1914.

Several of the more important peat beds in Italy have been worked chiefly with a view of utilizing the peat as fuel. Most of the peat is however too poor to compete with imported coal, hence the lack of success of all such undertakings even where they were connected with land reclamation schemes. Attempts have also been made to use peat for other purposes, such as litter, packing and isolating material, etc., but the quantities thus used are too insignificant to be of any economic importance. Of late, however, the nitrogen contained in peat has attracted considerable attention; this nitrogen is practically in an inert condition in the raw material and in order to utilize peat successfully as a manure, the nitrogen must be transformed into a more active compound such as a salt of ammonia.

The idea of subjecting peat to the water-gas process was suggested by Dr. L. MOND and the first plant erected for the purpose was that at Orentano in the province of Lucca, Italy; it has since been much improved by the addition of plant for preparing and drying the peat. The next important works of the kind were those at Osnabruck (Hanover) under the direction of Drs. FRANK and CARO, but owing to the difficulties connected with the preparation and drying of the peat, these works may be considered as being still in the experimental stage, as are other works started in England. The last works to be erected were those at Codigoro, Italy, where all difficulties have been successfully overcome. In fact the only two important undertakings for the utilization of peat are those of Orentano and Codigoro belonging to the "Società per l'utilizzazione dei combustibili italiani".

The process adopted for treating peat is the following: The peat, properly dried and broken up, is thrown into a turret-shaped oven 26 to 33 feet high, called the gas oven, which is fed at intervals from the top. The peat burns only in the lower part of the turret, the combustion being regulated by a jet of hot air and steam. The water vapour decomposes on the incandescent mass, producing, together with the other combustion gases, the so-called water gas, or in this case Mond gas, which collects in the top of the oven. It is produced at the lowest possible temperature and the nitrogen evolved from the peat combines with the nascent hydrogen and forms ammonia. The gas thus produced is then washed to free it from the tarry products it contains and led into a leaden chamber where it is met by a spray of sulphuric acid which converts the ammonia into sulphate, while the remaining gas is purified,

cooled and burned under the steam boilers, in the drying ovens or in gas motors. In this way about three-quarters of the quantity of nitrogen contained in the peat is converted into sulphate of ammonia. A peat containing 2.5 per cent. of nitrogen yields about 175 lbs. of sulphate of ammonia to the ton.

The first factory was erected at Orentano in 1907, but only began to work in 1910. At first the peat was dried in the open, but as this system proved quite unsatisfactory artificial drying was resorted to. Peat taken from the pit contains 50 per cent. by weight of water, and this quantity is now most successfully reduced to 25 per cent.

At present 1800 cu. ft of peat can be treated daily, yielding 50 tons of sulphate of ammonia per month, and before long the output will be doubled. The gas is used in the works and at a central station developing about 800 H.P.

The results obtained at Orentano encouraged the company to erect large works at Codigoro (Ferrara, Italy) in 1912; these are now capable of dealing with 150 tons of dried peat daily and of turning out from 10 to 12 tons of sulphate of ammonia per day. The peat beds at Codigoro are upwards of 2500 acres in extent. The Company has already spent £240 000 on the two factories, but it can now produce sulphate of ammonia at 4s 10d to 5s 7d per cwt. while the market price is above 12s per cwt.

715 - **Talbot Slag.** — DAFERT, O. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 5, pp. 301-302. Vienna, May 1914.

The "Talbot slag" obtained in the manufacture of steel by Talbot's process differs very little in outward appearance from ordinary basic slag.

According to the results of four analyses its composition varies as follows:

	Talbot slag		Basic slag. Average according to F. W. Dafert	
	Range per cent.	Average per cent.	I (*) per cent.	II (**) per cent.
MgO	3.75 - 4.60	4.25	2.97	—
CaO	45.70 - 50.42	48.10	47.33	45.26
MnO	3.50 - 6.46	4.91	4.51	6.44
Al ₂ O ₃	3.58 - 7.48	5.28	1.87	—
FeO	5.45 - 9.23	7.34	10.85	—
F ₂ O ₃	2.75 - 7.35	5.25	5.38	—
SiO ₂	8.86 - 10.04	9.48	8.34	8.83
P ₂ O ₅	14.01 - 17.90	15.99	17.38	18.49
S	0.22 - 0.88	0.51	0.42	—
SO ₃	traces - 0.16	0.08	0.28	—

(*) According to an older analysis. — (**) According to recent analysis.

The citric-acid-soluble phosphoric acid ranges from 74.2 to 90.1 or an average of 81.3 per cent. of the total phosphoric acid; it is thus within the usual limits of basic slag, from which it does not appear to differ much as a fertilizer. Manurial experiments now being carried out at the Vienna Experiment Station for Agricultural Chemistry will soon settle this point.

716 - **The Effect of one Crop upon Another.** — THE DUKE OF BEDFORD and PICKERING, S. U. in *Journal of Agriculture Science*, Vol. VI, Part 2, pp. 136-151, + 1 plate. Cambridge, May 1914.

AGRICULTURAL
BOTANY.
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

The writers review the results of the investigations on the effect of growing grass over the roots of fruit and other trees carried out at Woburn since 1895, and give an account of recent work on the effect of grasses and clover on various crops and on each other. In addition to field experiments, trees were grown in pots fitted with annular trays. Both metal and earthenware trays were used. The ratio of the weight of soil in the pot to that in the tray was 31.9 and the relative surface of the grass-grown soil in the tray to the surface of the pots was 1:2. All the water required to keep the pots up to a given weight was put into the trays. The dry weight of the matured crops was used to determine the effect of the different conditions.

Out of 23 instances only four showed a favourable effect and in 12 instances the effect of grass in the trays was to reduce the crop in the pots to an average of about one-half. The reduction varies with the crop, tobacco being more sensitive than tomatoes and mustard, and these more sensitive than barley. In the case of tobacco the amount of the reduction was proportional to the growth of grass, and, in a former experiment where the effect of 18 different grasses on apple trees was examined, the magnitude of the effect was found to vary with the vigour of the grasses.

Since the smaller crops (*i.e.* those in the pots below the grass-grown trays) remove less nitrogen from the soil, the soil in these pots should be richer in nitrogen than those without grass. Analysis of the soils showed this to be the case. Therefore the reduction in the growth of the crops under grass must be due to some toxic substance which reduces the power of the crop to utilise the available plant food.

Removal of the trays containing grass before maturity resulted in a great increase in the growth of the crop, so that the plants not only made up for lost lee-way, but actually outstripped those without grass. This effect was undoubtedly due to the destruction of the toxic substance by oxidation with the formation of beneficial products. Leachings from growing grass, if oxidised, were found to be beneficial instead of toxic, and it has been found that soil removed from grassed ground is more favourable to the growth of trees than that from similar tilled ground. Further, it is possible that partial grassing might have a beneficial effect, when the grass is at such a distance from the tree roots that the toxin becomes oxidised before reaching these roots. This was found to be the case at Woburn: apple trees with grass at a distance of 3 ft. from the stems grew more rapidly for a time than trees with grass 6 ft. away or with grass up to the stems.

Recovery from the toxic effect may not always occur, for this effect may produce permanent injury, especially in the case of hard-wooded plants.

The toxic effect between the same plants is greater than that between different plants. Also, the toxic effect of heating a soil is much greater than that produced by the growth of a crop in both cases the toxin, after oxidation, increases the fertility of the soil. There is therefore no reason for assuming that the toxin is an excretion from the plant, the debris from the growing roots being probably sufficient to account for its formation.

717— **The Action of Certain Nutrient and Non-nutrient Bases on Plant Growth** (1).

— McCool, M. M. in *Cornell University Agricultural Experiment Station, Memoir* No. 2, pp. 121-216, figs. 1-15. Ithaca, N. Y., August 1913.

I. *The antitoxic action of certain nutrient and non-nutrient bases with respect to plants.*

An extensive series of experiments has been made on the toxic and antidotal action of various ions on plant growth, particularly with respect to the elongation of the roots of seedlings. The chief conclusions of these experiments are as follows:

1) Each of the following radicles (in the order given) is poisonous to seedlings: Ba, Sr, NH_4 , Mg, Na, K.

2) Mutual antagonism exists between the following pairs of cations when present together in solution:

Mg and Sr	Na and K
K and Sr	Na and NH_4
Na and Sr	K and Ba
Mg and Ba.	

3) Calcium is the most effective of any of the substances studied in preventing toxic action.

4) Protective action is not confined to the so-called essential nutrients; Na, Sr and Ba (the non-essential ions) also possess this property.

The injurious action resulting when unbalanced conditions prevail, and the importance of calcium in correcting this action, make it probable that in many cases the beneficial effects obtained from calcium compounds are due to antagonistic relations. In any event the general trend of results indicates that where any single fertiliser has proved injurious it would be useful to apply a calcium compound, at least in limited quantity. Various theories have been advanced regarding the causes of antagonistic action between different ions, and the writer has made experiments which show that the permeability of the cell is altered, details of which will be published later.

II. *The toxicity of manganese and the antidotal relations between this and other cations with respect to green plants* (2).

Pure solutions of manganese salts are extremely poisonous to pea and wheat seedlings. The degree of toxicity is greatly reduced in full

(1) See also No. 13, B. Jan. 1914.

(2) See also No. 613, B July 1914.

nutrient solutions and in soil cultures. The injurious action appears chiefly in the upper portions of the plant, chlorosis being the first indication of an overdose. Protection from light diminishes the injurious effects. Calcium, potassium, sodium and magnesium ions are each effective in counteracting the poisonous action of manganese.

III. *The toxicity of various cations.*

Comparative studies of the poisonous action of the chlorides of calcium, potassium, sodium, magnesium, ammonium, barium, strontium and manganese in distilled water, in full nutrient solution and in soil cultures have been made. The concentrations in which no further elongation of seedlings takes place, those in which slight growth occurs and those that result in no injury to seedlings have been determined. Field pea seedlings were employed as indicators and in some cases wheat seedlings were also used. It was found that :

- 1) Calcium ions are the least toxic and require concentrations only a little lower than those causing plasmolysis to inhibit growth.
- 2) No appreciable root growth appears in solutions stronger than

$$\frac{N}{50} \text{ KCl}, \frac{N}{75} \text{ NaCl}, \frac{N}{500} \text{ MgCl}_2, \frac{N}{1000} \text{ NH}_4\text{Cl}, \frac{N}{4000} \text{ BaCl}_2 \text{ and } \frac{N}{5} \text{ SrCl}_2.$$

- 3) In full nutrient and soil cultures, the lethal concentrations of the various bases with the exception of strontium and barium, are practically identical, namely $\frac{N}{3}$ to $\frac{N}{5}$.

4) Under experimental conditions, much stronger solutions are required to prevent top growth than to kill the roots of seedlings.

5) Seedlings that have grown for 10 days in either distilled water, tap water, or full nutrient solutions, are far more resistant to any toxicant studied than are those that are placed immediately in the toxic solutions.

6) The chlorides of ammonium, magnesium, potassium, and calcium, in the order given, are injurious to germination in pure solutions and in soil cultures. These results suggest that fertilisers should be judiciously applied to soils.

An extensive bibliography and a review of previous work on this subject is also given.

718 - **Edible and Poisonous Fungi from the Nancy District.** — BERTRAND and SARTORY, A. in *Bulletin des séances de la Société des Sciences de Nancy*, Series III, Vol. XIV, No. 2, pp. 82-214. Nancy, April-July 1913.

An account of the edible, poisonous, and innocuous fungi, together with a key for identifying the Agaricineae, Polyporeae, Hydneae, Clavariaceae, Lycoperdeae, Morchelleae, Helvelleae and Pezizeae. Vernacular and scientific names are given; the distribution of the species according to the various soils is discussed; toxicity, poisons and antidotes are also discussed.

PLANT
BREEDING

719 — **Inheritance of the Capacity for Production.** (I) — ROEMER, TH. in *Führungs Landwirthschaftliche Zeitung*, Year 63, Part 8, pp. 257-268. Stuttgart, April 15, 1914.

Opinions are still divided as to the importance of Mendelian laws for breeding practice. The chief reason for this is the prominence given in agricultural breeding work to "performance", that is to the combined action of a more or less complex series of characters of a biological nature, which are much more difficult to observe and test than morphological ones. At the same time, the inheritance of such biological characters has been tested in a considerable number of cases, including: fertility in *Stizolobium*, self-sterility in *Cardamine pratensis* and *Reseda*, pollen sterility in potatoes, size of grain in maize, flintiness and flouriness in wheat and maize, chemical composition of the seed in maize, hardness in wheat, resistance to cold in *Mirabilis*, flowering-time in peas, production and quality of leaves in tobacco, standing power in wheat, rust-resistance in wheat, time of ripening in wheat, oats, barley and maize, discontinuity in the ear in barley, annual and biennial condition in *Hyoscyamus*, power of growth in ducks, fertility in hens, temperament in dogs, defects of vision (non-traumatic) in horses.

These investigations have shown that there is no essential difference in mode of inheritance between morphological and biological characters. In the splitting up in the second generation, however, biological characters show a preponderance of the ratio 1 : 2 : 1 over the ratio 3 : 1. These biological characters appear to be the expression of a number of units; this makes the investigation of the Mendelian inheritance of the capacity for production very difficult, as numerous slight variations which cannot be successfully grouped arise in the second generation.

From the above, the importance of Mendelism in breeding for productivity is already evident. As a complete analysis of the hybrids according to their capacity for production appears not to be possible, agricultural breeding work cannot make use of Mendelian laws to the same extent as some branches of horticultural work, in which the results of certain crosses can be predicted. At the same time we have to thank the new studies of heredity for the knowledge that in the crossing of two races all the possible combinations of the unit characters borne by each will turn up; further, that an abundant second generation will already show just what can be reached as the result of any particular cross, and that the progeny of an individual is the only sure test of its hereditary disposition and therefore of its breeding value, outward appearance being quite unreliable. These points hold for all types of breeding, while in breeding for productivity the knowledge that we can obtain forms surpassing the more productive of the two parents, and at the same time combining the valuable characters of both parents in a new and favourable manner, is highly important; in practice it allows an improvement in productivity to be obtained by crossing forms of equal productive power, that is to say without having to resort to parents which

(1) See also No. 1547, *B.* Nov. 1912; Nos. 490 and 495, *B.* May 1913; No. 959, *B.* Aug. 1913; and No. 1045, *B.* Sept. 1913. (Ed.)

may combine extremes of the desired character with insufficient development of other characters of production. As this departure from the average invariably appears in the second generation and can be determined in the offspring of these individuals, that is in the third generation families, the breeder may already reach a definite result by this third generation, without any fear of valuable material being unwittingly discarded.

720 - **International Factors connected with the Physiology of Germination in Wheat Grains.** — NILSSON-EHLE, H. (Svalöf, Sweden) in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 2, pp. 153-187 + 1 plate. Berlin, April 1914.

The following results have been reached after many years' study of the germination and anatomy of wheat.

1. The rapidity or slowness of germination immediately after ripening is a hereditary character distinctive for different varieties, and in the offspring of crosses shows decided segregation on the usual lines.

2. This physiological character is shown, both by comparison of different varieties and strains and by segregation after crossing, to be in the main independent of hardness (*Winterfestigkeit*) and early ripening, which characters depend on other internal factors. It is possible to combine high or low resistance to germination with high or low hardness and early-ripening properties.

3. These differences in germination characters between different varieties of wheat are connected with a series of internal hereditary factors.

4. Among these factors, that of «redness», which produces the red colour of the grain, is of special importance in hindering germination immediately after ripening. The white wheats, which generally lack red factors, germinate most readily; next come those with a single red factor, while those with several red factors germinate most slowly.

5. The germination characteristics of the different varieties are only partially dependent on the red factor; other internal factors act as co-determinants. In particular readiness to germinate and the specific course of this condition in individual varieties are probably independent of the red factors and dependent on other internal factors; at the same time the red factors act in preventing germination in the same direction as insufficient ripeness.

6. The observed facts throw fresh light on the important part played by the pericarp in the physiology of germination; the principal action is no doubt exerted by the corky layer, to which Schröder attributes regulation of the permeability and in which the red factor is localised.

7. The white and one-factor red wheats examined show somewhat more rapid absorption of water than those with more than one red factor.

8. The action of the red factors in hindering germination is at any rate partly exerted through their influence on the structure of the pericarp. In the absence of red factors the inner integument is thinner and more delicate than otherwise.

9. The pericarp consists of two quite separate integuments, insoluble in concentrated sulphuric acid; in red varieties each consists of two layers

of cells, while in white varieties the inner one is quite structureless in the ripe grain.

The writer considers this demonstration of a physiological characteristic composed of a number of internal factors as of considerable theoretical importance; the proof of this has been facilitated by the circumstance that the simultaneous morphological action of the factors is readily observable.

These observations are also in support of the theory that adaptation takes place by accumulation or some other type of combination of various hereditary factors.

It certainly seems that cultivated plants are more adapted for the study of general biological questions than wild ones, owing to the great variety of forms protected under cultivation; wild species, on the other hand, may often contain only adapted forms in which all the factors for a particular character are present together, preventing the possibility of any genetic analysis.

721 — **Xenia in *Phaseolus* Crosses.** — DANIEL, JEAN, in *Revue horticole*, Year 86, No. 11, pp. 253-257. Paris, June 1, 1914.

The Spanish bean (*Phaseolus multiflorus*) was crossed with the black Belgian bean (*P. vulgaris nanus*) and the resulting progeny were investigated more especially with regard to xenia (*i. e.* the reaction of the hybrid embryo on the surrounding tissues in the seed) exhibited by the seed coat.

The Spanish bean is large and spotted black and violet, while the Belgian bean is small and has a shiny black surface. Pedigree seed was used in the experiments. The pods obtained as a result of the cross in 1910 contained seeds in size and shape like those of the Spanish bean, but in colour shiny black like those of the male. The same cross in 1912 gave three kinds of pods: some which contained shiny black seeds, some which contained seeds of a chocolate brown colour and others whose seeds were light dun, showing that xenia may vary in intensity according to circumstances.

In all cases, sections showed that the pigment in the cells of the testa was the only character affected.

Two of the 1910 progeny mentioned above were sown in 1911. The resulting plants were exactly like the female parent (*i. e.* Spanish bean with red flowers); they were selfed, producing spotted seeds which were sown in 1912. In this next generation all cotyledons were hypogeous as in the maternal parent, which they also resembled in having the climbing habit. The flowers however were of three types: some plants had red flowers like the maternal parent; others had red standards with wings and keel white or white with red spots; others again had flowers of a dirty white colour. The all-red flowers yielded nothing but purple spotted seeds of various shades; the red-and-white flowers yielded brown spotted seeds and the white flowers yielded white seeds more or less reticulated (1).

(1) See No. 115, *B.* Feb. 1914.

(Ed.).

A plant belonging to each type was again selfed, and the resulting seeds again showed segregation, but without the recurrence of violet flowers or black testa.

- 722 - **The Inheritance of Germination Energy, Germination Capacity and Sensitiveness to Light in Seeds of *Poa pratensis*.** — PIEPER, H. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, No. 10, pp. 362-368. Stuttgart, May 15, 1914.

As the result of a series of tests with seeds of *Poa pratensis*, the variations of germination energy, of germination capacity and of sensitiveness to light appeared to be hereditary characters in the different strains. The possibility of using this fact in breeding work will depend on the correlation of the above characters with other desirable ones, the existence of which did not become apparent in the trials. Neither was it possible to decide from the trials whether the differences observed in the germination capacity were due to the structure of the seed or to that of the fruit.

- 723 - **Researches on the Germination Capacity and on the Capacity of the Plumule to Emerge from the Soil.** — GISEVIUS and CLAUS in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 9, pp. 297-318. Stuttgart, May 1, 1914.

AGRICULTURAL
SEEDS

The writers compare the germination capacity with the capacity of the plumule to emerge from the earth or from the layer of sand covering the seeds. They experimented upon 9 samples of winter rye, 42 of winter wheat and 24 of spring barley. The determination of the germination capacity was carried out at different times, according to the regulations of the Union of Agricultural Experiment Stations, in a germination box provided with ventilation and a thermostat, and always with four samples. The determination of the capacity of emerging was made in Hiltner boxes; these were partially filled with quartz sand the grains of which did not exceed 1 mm. in diameter; the seeds were pressed into this and covered with a layer 3 or 5 cm. deep of coarse sand (1 to 2.5 mm. diameter) which would not form a crust over the sprouting seeds. In this case also four tests were made for each sample. These boxes were placed in a room kept at the most uniform temperature possible of about 18° C.

The result of the investigation into the capacity of emergence of the plumule in rye, which was tested 100 and 160 days after harvest, was the following: if the determination of the energy and capacity of emergence of the plumule are to be determined by the same method as the energy and capacity of germination, the figures obtained on the 7th and 12th day using a covering of 3 cm. of sand are considered suitable. It is not yet known whether this would be the case also in spring (these experiments were made in November and January). The 5 cm. covering of sand did not offer any advantage over the 3 cm. covering.

Wheat was tested 33 and 153 days after harvest, barley 70 and 160 days after, but for oats the tests were not complete; for all three the same conditions as for rye may be taken.

It appears that the capacity of germination is generally greater than the capacity of emerging. As it was not possible to carry out both determinations immediately after reaping, a complete judgment on the significance

Report on seed examined in April 1914.

Kind of seed	Country of origin	Weed seeds		Other seeds		Percentage of non-germinable seeds	Percentage of diseased seeds	Quantity examined	Remarks
		Species	Percentage	Species	Percentage				
Dutch clover (<i>Trifolium repens</i>) . . .	England	<i>Crepis capillaris</i>	0.02	<i>Trifolium pratense</i>	0.01				
		<i>Prunella vulgaris</i>	0.10	<i>Plantago lanceolata</i>	0.57	1.24	nil	½ oz.	A little grit present.
		<i>Amaranthus retroflexus</i>	0.04	<i>Phleum pratense</i>	0.02				
		<i>Rumex acetosella</i>	19.26	<i>Holcus lanatus</i>	0.02				
Dutch clover (<i>Trifolium repens</i>) . . .	New Zealand			<i>Cichorium Intybus</i>	0.02				
		<i>Rumex acetosella</i>	3.05	<i>Plantago lanceolata</i>	0.42				
		<i>Prunella vulgaris</i>	0.01	<i>Phleum pratense</i>	0.04	3.25	nil	½ oz.	
				<i>Medicago lupulina</i>	0.04				
Niger seed (<i>Guizotia abyssinica</i>) . . .	India			<i>Cichorium Intybus</i>	0.14				
		<i>Cuscuta</i> sp.	0.77						
		<i>Raphanus</i>		<i>Sesamum indicum</i>	8.65	nil	nil	1 oz.	A large percentage of sand present.
		<i>Raphanistrum</i>	1.04						
Niger seed (<i>Guizotia abyssinica</i>) . . .	India	<i>Amaranthus retroflexus</i>	0.95						
		<i>Cuscuta</i> sp.	0.38						
		<i>Raphanus</i>		<i>Sesamum indicum</i>	1.56	nil	nil	1 oz.	A large percentage of sand present.
		<i>Raphanistrum</i>	0.37						
Niger seed (<i>Guizotia abyssinica</i>) . . .	India	<i>Amaranthus retroflexus</i>	0.34						

of the capacity of emerging is not yet possible. These experiments have, however, shown that there is a practical method for determining the capacity of emergence and that the greater amount of time required by the test is not so considerable as to prevent its being used instead of that for germination capacity; the emergence test is in itself more precise and, as these still incomplete experiments seem to point out, allows the concurrence of factors influencing the sprouting of seed, such as the effect of saline solutions or of an attack of *Fusarium*, to be distinctly recognised.

724 - **Impurities in Seeds in Victoria, Australia.** — Communicated by S. S. CAMERON
Director of Agriculture.

(See table on opposite page).

725 - **Researches on the Ears of Wheat and of Spelt for the Precise Characterisation of Varieties.** — KONDO, M. in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 5, pp. 713-817 + 3 figs. Berlin, 1913.

CEREAL AND
PULSE CROPS

These investigations extended to 62 winter wheats and 20 spring wheats (of which 80 were *Triticum vulgare* Vill.) and 16 spelts (*T. Spelta* L.). They were all of them of the 1911 crops and either bred at Hohenheim or the second crop from the original seed. Of each variety about thirty ears were selected and from these five typical ones were again picked out (large, medium and small); of each the awns, colour of the glumes, the presence of hairs, density of spikelets, weight and size of the ear, and colour of seed, were observed. Further investigations were made for each variety on groups of three ears (heavy, medium and light) as to the distribution of weight of the grains and spikelets in the ear and as to the constitution of the grains.

The results are the following: In common wheats the ears possessing medium density always show the highest weight of ear, the highest grain weight of ear and the greatest weight per thousand grains. In the dense-eared wheats the decline in the grain weight towards the tip is greater than in the medium or loose-eared ones. In the upper end of the ears the grains are much smaller than in the lower end. In medium and loose ears the weight of the grains is relatively the same. The best form of ear of common wheat is not the dense club form, but the medium parallel-sided form.

In spring wheat in general, the weight of the ears, of the total grain and of the thousand grains, as well as the number of ears and grains, are much lower than in winter wheats. The weight of the ears and of the grain of spelt are almost the same as in spring wheat. The number of grains in spelt is much inferior to that in winter and spring wheat. On the other hand the thousand-grain weight is higher. The belt of the heaviest grains in the ear varies according to the several varieties; in some it is in the central third of the ear, in others on the border between the central and lower third, or in the middle and lower third and often in the upper third. In the dense ears the belt is mostly on the limit between the lower and middle third. In the medium dense and loose ears it is in the middle third. In winter wheats the belt of the heaviest grains is scarcely ever in the upper

third, while in spring wheat it is most frequently in the middle or in the upper half of the ear. In spelt it is mostly in the middle of the ear and very rarely in the upper third.

In general it can be stated that in winter and spring wheat and in spelt the number of grains in a spikelet and the average grain weight are at their highest in the middle third of the ear. The ratio between the bottom and the top third is not constant, and varies according to the variety and species. In winter wheat in general, the lowest third is superior to the highest in every respect; in spring wheat the number of grains in the upper third and the individual grain weight in the lower third are at their lowest. In spelt the number of grains is smallest in the lower third and the individual grain weight is least in the upper third.

The distribution of grains in the ears is characteristic of the several varieties. In general the length of the rachis, the number of grains, the total grain weight and the thousand-grain weight vary with weight of the ear, but inversely with the density of the spikelet and the number of sterile spikelets in the lower part of the ear. The ratio between weight of ear and the number of spikelets and the density of the grain is not constant. It is therefore not advantageous to endeavour to breed wheat for greater density of spikelets, but it is very important to improve the lower part of the ear.

As for the colour of the grain, which depends upon various conditions, white and red may be assumed to be the fundamental colours which form the characters of the different varieties. The colour depends chiefly upon the pigment in the pericarp and only secondarily upon the mealiness or flintiness. In each ear the colour of the grain is quite uniform.

The form of the full grain and the presence or absence of the depression in the longitudinal furrow on the flat side of the grain are to be considered as characters of the variety. The hairs at the tip of winter and spring wheat grains are thick-walled, with narrow lumen, and straight; they vary in length according to the variety. The hairs of spelt possess relatively thin walls, and large lumina; they are often twisted and are longer than in common wheat. The length of these hairs is a character of the variety.

The writer considers size and weight of the wheat grains as to a certain degree characters of variety and species; mealiness and flintiness are also characters of variety in spite of the fact that they are not invariable.

An important character for the determination of variety and species is the middle layer of the four which make up the pericarp in the species of *Triticum*.

726 - Six Years' Trials of Winter Wheats in Denmark (1907-1912). — From Report of the Danish Crop Experiment Organisation (1). — Communicated by the Committee on Plant Breeding.

These trials were carried out at the Experiment Stations at Abed (Lolland) and Tystofte (West Zealand); the experiment ground is in each case on a good loam.

(1) A full report is given in *Tidsskrift for Landbrugets Planicavl*, price 6 kr. (6s 7d) the vol. of 800 pp.

At Tystofte two series of trials were made each year, one after bare fallow and the other after a fallow cropped with turnips; at Abed the wheat was always sown on bare fallow land. In each trial there were 6 to 8 adjacent plots of $\frac{1}{200}$ tondeland (33 sq. yds.) in area; on every third plot Tystofte Standwell was grown for comparison. Altogether 23 varieties were grown, 8 of them in all the trials; the yields of the others were calculated in comparison with the average of these eight.

The winters were on the whole favourable; in one of the six trials at Abed some damage was done, but at Tystofte none. For this reason the less hardy varieties gave relatively high yields.

Heaviest croppers. — A yield of 43 to 44 ctn. per tondeland (58 to 59 bushels per acre) was given by: 1) Queen Wilhelmina II, 2) Tystofte Small II, and 3) Tystofte Standwell II. All three are improvements on the originals of the same name obtained at Tystofte; they none of them differ from their originals except in giving 8 to 10 bushels more grain.

Queen Wilhelmina II gives a very heavy yield under favourable conditions; it is not very tall and tillers relatively little, but stands very straight; it is, however, not very hardy, about equalling the ordinary Squarehead.

Tystofte Small II can be relied upon to give a heavy yield; it tillers rather more than the preceding, but is somewhat liable to lodge.

Tystofte Standwell II has a rather shorter and stiffer straw than the Small; it is very hardy and tillers well, but for this reason may grow too thick and become liable to lodging or to imperfect development of the grain; it stands late sowing better than the other two. At Tystofte it gave a lower yield than the Small after bare fallow, but beat the latter after a cropped fallow.

Second group. — The following gave a yield of 39 to 41 ctn. per tondeland (52 $\frac{1}{2}$ to 55 bushels per acre): 4) Abed Large-eared, 5) Svalöf Extra Squarehead II, 6) Svalöf Grenadier II, 7) Carter's Standup, 8) Webb's New Standup, and 9) Svälöf Sun.

Abed Large-eared tillers fairly well, is only moderately hardy, but stands very straight; with favourable weather it gives a plentiful crop of grain; the bushel-weight is below the average.

Of the Svalöf varieties, Extra Squarehead II is very hardy, Grenadier II only moderately so; these give some 2 to 4 bushels more than the older varieties of the same names. The Sun wheat is very hardy; at Abed it did better than the other two, but at Tystofte less well.

Webb's and Carter's Standup wheats are very much alike; they tiller little, are not very hardy and have short and stiff straw; under favourable conditions they are heavy croppers and at the same time stand up well.

Light croppers. — Yields of 33-37 ctn. per tondeland (44 $\frac{1}{2}$ to 48 $\frac{1}{2}$ bu. per acre) were given by: 10) Tystofte Bearded, 11) Strube's Bearded No. 56, 12) Scotch Squarehead from Lidsö, 13) Strube's Squarehead, 14) Erh. Frederiksen's Squarehead, 15) Bencard's Red, 16) Svalöf Auger, and 17) Abed Lancet.

Minnesota No. 529 gives only 24 ctn. (31.3 bu. per acre) of grain.

727 - Field Trials with Spring Wheat (1) and Oats in Germany in 1909-10. — 1. ZADE, A. Haferanbauversuche auf leichteren Böden 1909-10. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, No. 252, 99 pp. — 2. ROSE, H. Sommerweizenanbauversuche 1909-10. — *Ibid.*, 59 pp. Berlin, 1913.

I. Trials of oats on light soils.

The number of experiments was 50 in 1909 and 56 in 1910; they were distributed over the whole of Germany. The three varieties taken in the main trials were: Leutewitz Yellow, F. von Lochow's Yellow and Svalöf Golden Rain.

The reports are drawn up like those of the other variety trials made by the German Agricultural Society. The positions of the three varieties as regards the various qualities are shown in the following table:

	Yield of grain		Yield of straw		Resistance to lodging		Bushel weight		Percentage of chaff (1)	
	1909	1910	1909	1910	1909	1910	1909	1910	1909	1910
F. von Lochow's Yellow.	I	I	III	III	II (2)	III	II	II	I	I
Svalöf Golden Rain.	II	III	I	I	I	I	I	I	II	II
Leutewitz Yellow.	III	II	II	II	II (2)	II	III	III	III	III

(1) I = lowest. — (2) Equal and.

It is seen that the results for the two years are fairly concordant.

II. Trials of spring wheats.

The trials of wheats were made at 37 places in 1909 and 38 in 1910. The varieties taken for comparison were Rimpau's Red Schlanstedt for early sowing, good soils and favourable weather conditions, and Strube's Bearded for later sowing, light soils and unfavourable weather conditions; the other trial varieties were Heine's Japhet and Wohltmann's Blue Dame.

The average yields of grain of the four varieties are shown in the accompanying table (in lbs. per acre).

	Comparison of all four varieties		Comparison of three varieties	
	1909 (13 trials)	1910 (10 trials)	1909 (12 trials)	1910 (19 trials)
Rimpau's Red Schlanstedt	2 865	2 040	2 700	2 358
Strube's Bearded	2 579	2 158	—	—
Heine's Japhet.	2 869	2 032	2 740	2 410
Wohltmann's Blue Dame	2 654	1 828	2 643	2 200

(1) For loose-eared varieties of winter wheat, see No. 227, B. March 1914 (*Abstract of Arbeiten der D. L. G.*, No. 248). (Ed.).

Rimpau's Red and Heine's Japhet are seen to be very nearly equal, while Blue Dame comes decidedly behind them. Strube's Bearded was the best in 1910 under certain circumstances, such as soils hardly to be classed as wheat land, unfavourable places, or East German continental conditions with low rainfall. For straw yield Rimpau's Red and Strube's Bearded came off best; Blue Dame was lowest in this respect, but at the same time the most resistant to lodging. Strube's Bearded showed the shortest period of growth in each year; it also gave the flintiest grain.

Results of preliminary trials of other varieties are also given.

728 - **The Early Fruwirth Goldthorpe Barley.** — WACKER, H. in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 2, pp. 233-248. Berlin, April 1914.

The writer describes the origin of the Early Fruwirth Goldthorpe barley, which is a pure line in Johannsen's sense; it is descended from a plant observed by Fruwirth in 1899 in a field of Goldthorpe barley on the experimental ground of Hohenheim Agricultural College. The variety, which the hairs on the rachilla shew to belong to *Hordeum distichum erectum*, is described as follows: It exhibits a close-set ear of medium length, with fairly wide spreading awns. The grain is of medium length and stout, of a yellowish-white colour, with rather narrower glumes than ordinary Goldthorpe barley, and has a high starch content. The stem is of medium length, rather thin, but wiry and strong, and therefore does not easily lodge. The yielding capacity is excellent, and ripening takes place 8 or 10 days earlier than with ordinary Goldthorpe barley. Smut occurs very rarely, as the spikelet remains closed after flowering. This fact also precludes any chance of cross-fertilization. Nevertheless, in 1908 some plants appeared among the descendants of plants selected in 1899-1902 for early maturity and grain yield and simply allowed to multiply from 1902 to 1907, which produced descendants differing from others in the colour of the grain and in the strength of the stem. According to the writer, spontaneous variations within the pure line must therefore have occurred.

Cultivation is now being carried on with a view to further improving the variety, which has been included in the Register of the German Agricultural Society.

729 - **Formation of Aerial Tubers in Potatoes.** — FORRIG, TH. in *Monatshefte für Landwirtschaft*, Year III, Part 5-6, pp. 111-120 + 3 figs. Vienna and Leipzig, 1914.

ROOT CROP

The writer has observed the occurrence of aerial tubers in the potato varieties Topas (since 1910) and Marius, and occasionally in a selection from Prof. Wohltmann. These tubers occur on the main stem and branches, singly or in clusters, and may be as big as pigeon's eggs; they are grass-green with purple spots. They often bear nodosities, from which, or from the tubers themselves, rosettes of soft leaves may arise. The formation of aerial tubers takes place especially on haulms which have got bent down to the ground, but in this case the tubers may be of normal size. The writer believes the occurrence to be favoured by heavy manuring combined with cool damp weather.

On planting some of the 1910 aerial tubers of Topas, yields were obtained in 1912 and 1913 heavier than the average of the variety.

- 730 - *Dalembertia populifolia*: an Edible Plant in Mexico. — Bois, D., and DISCET, L., in *L'Agriculture pratique des pays chauds*, Year XIV, No. 134, pp. 257-265. Paris, May 1914.

Dalembertia populifolia Baillon, known as "Jicama de baryta" or "Jicama del cerro", is a shrub; at certain times of the year its roots produce tuberous swellings which are edible and are sold in large quantities in Central Mexico. The plant only exists in the wild state and to collect the tubers, which are usually close under the surface of the ground, a hole is first dug close to the stem, and the roots are followed horizontally, care being taken not to injure the base of the stems, as the plant is perennial. The writers cultivated the plant experimentally and found that it could be propagated by seeds and cuttings, but that the tubers could not be used for this purpose. Though containing little nutritive matter, *Dalembertia* is popular as an article of diet, either cooked or raw, and is eaten either alone or with other foods; it is of special value for quenching thirst on a long march in the burning sun.

FORAGE CROPS.
MEADOWS
AND PASTURES

- 731 - Observations on the Laying-down and Care of Permanent Pastures. — ELOFSON, A., in *Svenska Mosskulturföreningens Tidskrift*, Year 27, No. 2, pp. 77-95. Jönköping, March 1914. (From the writers summary).

The writer begins by calling to mind the great importance of cattle-breeding in relation to the national food supply, as well as to agriculture, especially in districts unsuited to arable farming. With the aid of control societies, a gross return had been reached in cattle breeding such as could scarcely have been dreamt of before, but those stock-farms which were carried on on highly intensive lines were now merely marking time, or even declining, both as regards their milk-production, and also in return per 100 food units. The zenith, as regards the capacity of the animals, had therefore been reached, and the net returns now no longer corresponded to the high gross figures.

The writer sees the reason for this in the fact that too much stress has been placed on the results of chemico-biological research in scientific cattle feeding, without reference to the great demands of biology, an omission which is bound to bring retribution, since the attainments of the animals must always in the long run depend on their constitutions. The fruits of intensive, unnatural stall-feeding are decreased power of resistance, lessened reproductive power, etc.: hence great expense in rearing fresh stock, and less complete utilization of raw foodstuffs.

The main food should consist of hay and roots in winter and pasture in summer. Special attention should be paid to the improvement of hay-production, so that a heavy, and also cheap, crop may be forthcoming. When hay can be produced, as it is on several farms in Sweden, at 25 to 32s per ton, it forms a cheap feed, even when used in large quantities.

Pasturage is the cheapest food, in relation to production, that there is, as modern Swedish pasture farming also demonstrates. Since pasture farming on a large scale considerably diminishes the farmer's labour-bill, and provides him with the greatest possible quantity of foodstuff per unit of area (1), the writer recommends Swedish farmers to make use of the advantages of modern pasture farming. The first step in this direction is the improvement of great areas of natural pasture. It is to be noted that only such areas as are not very well suited for growing cereals should be used for this purpose, or at least only so much of the better land as circumstances may demand: for example, if young stock is to be raised and there is no other land available, or where pasture for dairy cattle is required close to the homestead. Pasture farming on a large scale should not be allowed to interfere with the output of cereals.

The preliminary conditions necessary to make permanent pastures pay are present in Sweden. For land is cheap and the distribution of the rainfall is favorable; most rain falls in late summer, when the pastures are most sensitive to drought. Our light nights, and the fact that the energy of growth increases as the northern frontier is approached, make the production decidedly large in proportion to the length of the growing period.

In laying down permanent pastures, especial attention must be paid to manuring. For sowing in a bleak climate, the seed must be of varieties which stand the winter well. These are not usually in stock on the seed markets, but they grow wild everywhere in northern countries, and include, for example, meadow fescue, red fescue, smooth-stalked meadow-grass, rough-stalked meadow-grass, foxtail, etc. A firm seed-bed and a heavy seeding are essential conditions for the success of the pasture.

The dressing of manure should be:

8 to 16 cwt. lime	} every three years.
{ 2 ½ to 3 ¼ cwt. superphosphate	
or 5 to 7 cwt. basic slag	
5 to 6 ½ cwt. kainit	

Heavy and dry soils should get as much manure supplying humus as possible; nitrogen should be given according to requirements: the quantity used in these parts is about ½ cwt. of nitrate of soda and sulphate of ammonia an acre a year.

The results so far obtained in Sweden are satisfactory. At Vallinge, in Södermanland, Hr. Kleen obtained 1200 food-units (2) an acre at a cost of production of £3 5s, including all expenses. This works out at two thirds of a penny per food-unit. If foodstuffs have to be purchased, the cost of production rises to at least twice as much.

(1) Experiments in Denmark shew that grass mown 6 times (e. g. Cocksfoot) gives a lighter crop of hay, but a larger amount of digestible foodstuff, than when mown only twice. ("Om Vacksten af Hundegräs och Drapshavre", etc., by E. LINHARD, in *Tidskrift för Landbrugets Planteavl*).

(2) A food-unit is equal to about 1.33 lb. of starch value.

The daily increase in live-weight of young stock amounts to 600 to 700 gms. (20 to 25 oz.) per head. At Latorp, where the mean rainfall is 13.7 in. for the six months April to September the increase per head per day exceeded 900 gms. (2 lbs.).

On the experimental farm of the Swedish Moor Cultivation Society at Flahult, near Jönköping, excellent results have also been obtained from peat soils, with a net profit of over £2 4s per acre.

In Central Sweden the pasturage period lasts about 150 days, that is about the same as in Germany.

732 - *Beckmannia erucaeformis* Host., a New Grass for Moor Meadows. — WITTMACK, L. (Berlin) in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXIX, Nos. 22 and 24, pp. 309-312 and 356, + 3 plates. Berlin, May 30 and June 13, 1914.

The writers gives a description of *Beckmannia erucaeformis* Host.; this grass has also been referred to *Phalaris* (Linnaeus) and *Cynosurus* (Aiton and Willdenow), but is now made the only representative of the genus *Beckmannia*.

This species is found in Italy, Hungary, S. E. and E. Europe, N. and C. Asia, and in America from Alaska to Minnesota; several varieties have been described. It occurs along rivers and in swamps, in Russia also in saline marshes. In Germany it has been introduced here and there.

There is little information as to its feeding value. In Russia, where it has already been grown on a large scale in some places, it is considered useful, though giving a rather coarse hay. It appears to resist frosts and fungi, and grows very tall. The abundance of salts characteristic of most of its stations in Russia does not seem to be essential. The production of seed is abundant, in spite of its perennial character; the trade "seed" consists of the whole spikelets.

733 - A Fodder for the Dry Season: *Tripsacum fasciculatum* Trinius. — PEDROSO, A. in *Journal d'Agriculture Tropicale*, Year 14, No. 155, pp. 137-138. Paris, May 31, 1914.

Trials have been carried out in Costa Rica with *Tripsacum fasciculatum* Trinius, a perennial grass somewhat similar to sugarcane in appearance. It may reach a height of more than 16 ft., produces adventitious roots and continues to vegetate almost indefinitely. Cattle eat it readily, horses rather less willingly and then only the leaves or the young stems cut up. The special advantage of *Tripsacum* is that it remains green during the dry season and yields good crops even on poor soil.

Propagation takes place by means of slips which are set about 3 ½ in. deep and 20 in. apart. For the first six months after planting the land must be kept hoed and free from weeds. Four cuts per annum are obtained, the last of which should take place at least one month before the end of the rainy season in order that the plant should be sufficiently recovered to stand the subsequent drought.

734 - **African *Bombax*.** — VUILLET, J. in *L'Agronomie coloniale*, Year I, No. 10, pp. 97-105. Paris, April 30. 1914.

FIBRE CROPS

The existence of numerous natural hybrids makes it frequently very difficult to identify the various species and varieties of *Bombax*; moreover complete specimens of the trees are not easy to obtain, as they only flower after the leaves have fallen, and the new shoots do not appear till after the fruits have dropped. The writer distinguishes four *Bombax* in the Nigerian Soudan:

1. *B. with ribbed fruits.* — The ovary has five well marked furrows on its upper half, which alternate with the lines corresponding to the valvular sutures in the fruit and form a five-toothed crown at the top; the capsule has five deep inter-sutural furrows clearly defined in the upper half; the seeds are sub-spherical instead of pyriform.

2. *B. with papillose fruits* — Calyx not very villous and only half the length of the flower instead of two-thirds; capsules slightly papillose.

3. *B. with long fruits* — Calyx always longer than half its diameter and showing a very irregular edge when burst by the opening flower; ovary longer than in other species (6 to 7 mm. in diameter at the base by 10 mm. long) and not concave at the top; fruits sub-cylindrical and drawn out in the shape of a sausage.

4. *B. with yellow flowers.* — Leaves usually made up of five leaflets, thicker and forming a more obtuse angle at the base than other Soudan species; flowers yellow or yellowish-green on the outer surface of the petals, brighter yellow on the inside; fruits slightly furrowed at the base and having small ridges in the upper half.

735 - **The Oil Palm (*Elaeis guineensis*).** — BECCARI, ODOARDO in *L'Agricoltura coloniale*, Year VIII, Nos. 1-4, pp. 5, 108, 201, 255. Florence, January-April 1914.

CROPS
YIELDING OILS,
DYES AND
TANNINS

The writer discusses the work of ADAM and of CHEVALIER on *Elaeis* and draws up the following classification of the oil palms to serve as a basis in selecting and breeding new varieties for cultivation. He also describes a new variety, *E. guineensis macrocarpa* Becc., with remarkably large fruits, the nut of which varies in weight from 23 gm. to 54 gm. (1 to 2 oz.) and may measure up to 50 × 43 mm.; the shell of the nut is very thick and the kernel is small and irregular in shape; the albumen has a rather large central cavity and the albumen tissue is made up of larger cells than that of any other variety and contains a larger number of crystalloids.

Classification of Elaeis.

Species	Varieties	Previously called:
<i>E. guineensis</i> Jacq.	<i>angulosa</i> Becc.	"Ökpörö Eyop", Bull. Misc. Inf. Kew, 1909, No. 2.
	<i>albescens</i> Becc.	"Abefita", Bull. Misc. Inf. Kew, 1909, No. 2.
	<i>communis</i> Aug. Chev.	—
	form <i>androgina</i> Aug. Chev. . . .	—
	" <i>divisa</i> Aug. Chev.	—
	" <i>ramosa</i> Aug. Chev.	—
	sub. var. <i>dura</i> Becc.	<i>E. nigrescens</i> (typ. Aug Chev. Documents, p. 47
	" <i>fatua</i> Becc.	"Abe-dam" Bull. Misc. Inf. Kew, 1909, No. 2.
	" <i>leucocarpa</i> Becc.	<i>E. nigrescens communis</i> (<i>vulgaris</i>) Aug. Chev. Doc. p. 50.
	" <i>semi-dura</i> Becc.	"Abe-tuntun", Bull. Misc. Inf. Kew, 1909, No. 2.
	" <i>tenera</i> Becc.	<i>E. nigrescens communis</i> Aug. Chev., Doc., p. 49.
	<i>gracilinux</i> Aug. Chev.	—
	<i>idolatrix</i> Aug. Chev.	—
	<i>intermedia</i> Aug. Chev.	—
	<i>macrocarpa</i> Aug. Chev.	—
	<i>macrophylla</i> Aug. Chev.	—
	<i>pisifera</i> Aug. Chev.	—
	<i>repanda</i> Aug. Chev.	—
	<i>rostrata</i> Becc.	"Mbana Eop", Bull. Misc. Inf. Kew, 1909, No. 2.
	<i>macrocarpa</i> Becc.	—
<i>E. madagascariensis</i> Becc.	<i>E. guineensis</i> var. <i>madagascariensis</i> Jum. et Perrier de la Bâthie.
<i>E. melanococca</i> Gaertn.	—

737 - **Tapping Trials with *Funtumia elastica* in the Belgian Congo.** — GISELAIRE, A. in *Bulletin agricole du Congo belge*, Vol. V, No. 1, pp. 95-104. Brussels, March 1914.

Tapping experiments were carried out in the Bangala district on trees 7 to 9 years old. The tapping was done in the early morning, being finished at half-past eight or nine at the latest; herring-bone incisions were employed, single or double according to the size of the trunk, all trees of over 20 in. circumference at 3 ft. from the soil receiving the double incision; lateral incisions were 10 in. from the central incisions and large trees were tapped to a height of 16 ft. Coagulation was brought about by boiling water.

The following results were obtained at Musa: 1696 trees yielded 75 gallons of latex from which 375 lbs. of raw rubber were coagulated, or 3.6 oz. per tree including scrap. As the trees can probably be tapped twice a year this quantity should be doubled to estimate the annual production.

At Katu, 1368 *Funtumia* yielded 67 gallons of latex from which 345 lbs. of raw rubber were obtained, or 4.3 oz. per tree including scrap. The rubber lost 23 per cent. on drying so that 3.3 oz. of dry rubber were obtained per tree or 6.6 oz. per tree per annum, and one acre planted 10 ft. apart would yield 200 lbs. of dry rubber per annum.

Samples from both localities were submitted to experts, who reported favourably on their quality and estimated their value as equal to that of plantation hevea.

738 - **The Nipa Palm (1) as a Commercial Source of Sugar.** — PRATT, D. S., THURLOW, L. W., WILLIAMS, R. R., and GIBBS, H. D., in *The Philippine Journal of Science*, Vol. VIII, Section A, No. 6, pp. 377-398. Manila, December 1913.

SUGAR
CROPS

The nipa palm (*Nipa fruticans* Wurm.) covers large tracts of land in the Philippines which amount to 18 000 hectares (45 000 acres) in the provinces of Bulacan and Pampanga alone. Up to the present the sap exuded by the flower stalk has only been utilized on a large scale as a commercial source of alcohol; it was examined by the writers with regard to the possibility of extracting the sugar contained.

The yield amounts to about 40 litres (9 ½ gallons) of sap per season of 150 days per annum, or, with 750 trees per hectare, to 30 000 litres per hectare (2650 galls. per acre) per annum, the maximum flow occurring during the second month. As it flows from the palm the sap contains about 15 per cent. of saccharose and has an apparent purity of not less than 85, only traces of invert sugar being present; the addition of about 0.5 per cent. of sodium chloride slightly reduces the purity without lowering the extraction of sugar as it is classed among the non-melassigenic salts; waxes, acids, pectins and other foreign materials are practically absent; the sap contains active enzymes of the invertase and peroxidase types, the latter being present only during the final period of secretion and being capable of oxidizing sucrose and invert sugar in either neutral or alkaline solution.

(1) See No. 2884, B. Aug.-Sep.-Oct. 1911 and No. 604, B. May 1913.

(Ed.)

The sap is usually collected in bamboo tubes known as "tuquils", containing a little milk of lime and sulphite, which destroy the enzymes and avoid the necessity of subsequent bleaching; the use of small funnels to convey the juice to the bottom of the tuquils avoids stratification and results in more perfect conservation with but small additional expense. The total cost of collecting the sap and delivering it to the mill amounts to \$1.50 per 1000 litres (2s 9d per 100 galls.).

A thousand litres of sap yield on an average 115 kg. of commercial white sugar polarising at from 99° to 99.5°. No important modification of methods now used in sugar practise is necessary in dealing with nipa juice; furthermore, no expense corresponding to the grinding of cane or the extraction of beets need be incurred, while the fuel supplied by the bagasse may be easily substituted by the cheap and plentiful wood of mangrove swamps.

As about 9 000 litres of sap are required to produce 1 ton of 96° sugar, 90 000 litres daily would be required to run a 10 ton mill at full capacity, that is the produce of 450 hectares. A mill designed to manufacture sugar from nipa juice would be available for refining Philippine sugar during that portion of the year when no sap is flowing, a process in which there is a reasonable profit. All estimates are conservative and there is every indication of the establishment of a successful industry.

The Bureau of Science (Manila) will gladly furnish samples of nipa sugar to any one interested.

739 - **Analysis of Sugar-Beets.** — PELLET, H. in *Sucrierie Indigène et Coloniale*, Vol. LXXXIII, Nos. 19 and 20, pp. 441-446 and 466-471. Paris, May 13 and 20, 1914.

As the result of a long series of analyses, the writer concludes there is no relation between the size of sugar-beets and their sugar content.

740 - **The Cultivation of Cacao in Trinidad and the Gold Coast.** — FREEMAN, W. G. in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 79, pp. 75-83. Trinidad, March-April 1914.

A reply to an article in the *Philippine Agricultural Review* attributing the recent decline in the exports of Cacao from Trinidad to bad cultural practices, overshadowing of trees and severe fungus disease.

The writer points out that this decline corresponds to seasons of abnormally low rainfall and gives figures showing a considerable improvement in the production of cacao during 1913 corresponding to an improvement in the climatic conditions. Reference is also made to reports of the Gold Coast Department of Agriculture showing that the remarkable increase in the exports of cacao from West Africa is due to the natural advantages of suitable areas and cheap labour, rather than to the application of scientific horticultural methods.

741 - **Manurial Experiments with Tobacco.** — VRIES, O. in *Proefstation voor Versenlandsche Takak. Mededeelin* No. IX, pp. 42. Amsterdam.

Manurial trials with tobacco were carried out on poor soils in Java during the years 1912 and 1913, with the object of determining the effect of the fertilizers on the quality of the tobacco.

The following results were obtained : on the "brown" soils potash had little effect on the quality of tobacco, while superphosphate injured its combustibility without spoiling the colour of the ash ; on the blue clay and sandy soils potash was again without action, while superphosphate sometimes proved beneficial and sometimes harmful both to the combustibility and to the colour of the ash. Sulphate of ammonia had no harmful effects and occasionally affected the quality beneficially ; its use is therefore advocated, as it always increases the yield.

742 - **Experiments in Harvesting Tobacco Leaves.** — DE VRIES, O. in *Proefstation voor Vorstenlandsche Tabak, Mededeelen*, No. VIII, pp. 43. Amsterdam.

Experiments on methods of harvesting tobacco leaves were carried out during 1912 and 1913 in Java. It is recommended that all picking should be done in the early part of the day and that leaves from the lower parts of the plants should be picked singly, except in wet years, when it would probably be better to pick the whole plant at once, for in that case the over-maturity of the lower leaves would be an advantage during the curing process.

743 - **The Market-Gardening Districts of Northern Germany.** — WEIRUP, in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, No. 250, pp. 1-40. Berlin, 1913.

The above publication is a report of the horticultural conditions in the Luneburg district, in the Hamburg district and in West Holstein presented to the "Deutsche Landwirtschafts-Gesellschaft". These districts are partly under fruit trees and partly under early potatoes, strawberries, rhubarb and vegetables. The chief markets are Hamburg and Altona, but at the present time these outlets are not sufficient to deal with all the cabbages produced, and the marketing conditions generally should be improved. The large market at Hamburg with its store rooms is specially described, also the premises of the "Fruchthandel-Gesellschaft" of Bremen, which organises the supplies of fresh market-garden produce not only from the local districts but also from more distant ones.

MARKET
GARDENING

744 - **Fruit Growing in Australia.** — HATTRICK, J. M. in *Deutsche Obstbauzeitung*, No. 11, pp. 231-244. Stuttgart, June 1, 1914.

FRUIT
GROWING

The rural population of Australia is small as compared with the urban population — the total population only amounting to five millions — and of

TABLE I. — *Distribution of surface (acres).*

	Total area	Total area cultivated	Under cereals	Vineyards	Fruit plantations
Western Australia	624 588 800	855 023	648 801	2 795	16 737
South Australia	243 244 800	4 141 992	2 228 482	22 952	22 411
Victoria	56 245 760	5 386 247	2 877 315	23 412	57 375
Tasmania	16 777 600	5 380 971	142 666	—	24 919
New South Wales	198 054 400	3 381 920	2 436 050	8 036	47 354
Queensland	431 120 000	935 021	295 801	1 633	17 466
New Zealand	67 040 600	16 265 889	692 565	781	31 952

TABLE II. — *Area under the different kinds of fruit, in acres.*

Kind of fruit	Western Australia	South Australia	Victoria	Tasmania	New South Wales	Queensland	Total
<i>Hard fruit:</i>							
Apples	9 956	10 183	22 164	22 678	11 165	1 238	77 384
Pears.	1 211	996	6 338	—	2 590	54	11 189
Quinces.	—	—	810	—	531	8	1 340
<i>Stone fruit:</i>							
Apricots	521	1 735	2 441	—	880	47	5 624
Cherries.	—	838	2 755	—	1 532	30	5 155
Peaches.	1 352	1 710	4 095	—	7 006	615	14 778
Plums	823	1 340	4 903	—	1 411	210	8 696
Nectarines	—	—	59	—	—	45	104
Persimmons.	—	—	5	—	141	15	161
<i>Nuts:</i>							
Coconuts	—	—	—	—	—	237	237
Hazel nuts	—	—	400	—	—	—	400
Almonds	—	2 778	260	—	—	2	3 040
Walnuts	—	—	800	—	—	—	800
<i>Citrus fruits:</i>							
Oranges	1 026	2 014	860	—	14 468	3 450	21 818
Lemons.	220	553	680	—	3 680	47	5 180
Tangerines	—	—	—	—	4 643	—	4 643
<i>Other fruits (tropical, etc.)</i>							
Pineapples	—	—	—	—	—	2 417	2 417
Figs	600	—	440	—	—	15	1 055
Bananas	326	—	—	—	—	6 402	6 788
Custard-apples	—	—	—	—	—	50	50
Loquats	—	—	64	—	—	—	64
Papaws	—	—	—	—	—	185	185
Passion fruit.	—	—	50	—	57	12	119
Breadfruit.	—	—	—	—	—	366	366
Small fruit	714	272	6 240	—	126	808	8 160
Unclassified	—	—	—	4 238	—	—	4 238
Total . . .	16 748	22 428	53 364	26 916	48 230	16 313	184 000

TABLE III. — *Average yields of fruit per tree, lbs.*

Kind of fruit	Queensland	N. S. W.	Victoria	S. Australia	W. Australia	Tasmania
Apple	22	45	46	30	26	29
Orange	81	49	66	44	27	—
Peach	—	46	52	26	27	—
Pear	—	57	88	56	43	—
Plum	—	65	51	45	—	—
Apricot	34 to 38 throughout Australia					
Cherry	21 to 28 " "					
Lemon	—	53	—	—	—	—
Tangerine	—	51	—	—	—	—
Almond	—	—	—	2½	—	—
Banana	178 bunches p. acre					
Pineapple	318 doz. fruits "					

the rural population only a small part grow fruit. Yet the area under fruit is already considerable in spite of the industry being still in its infancy. Table I gives the distribution of the area in 1911 in Australia and New Zealand.

In every State except South Australia the area under vineyards is smaller than that under fruit trees; the latter has increased at the rate of about 4500 acres per annum for the last ten years in Australia and New Zealand.

Kinds of fruit. — The climate being well adapted to fruit growing, especially in the coastal regions (S. Queensland), most kinds flourish; the distribution of the various kinds is given in Table II.

There are no available data for New Zealand and it is pointed out that as different methods of collecting the returns are employed in the various States, the figures are only approximate.

The most important Australian fruit is the apple, followed at a distance by orange, peach, pear, plum, and small fruit. Queensland produces the tropical fruits (oranges, bananas and pineapples), New South Wales grows citrus fruit more especially, but peaches, apples and pears also flourish there; in Victoria, the so-called "Orchard State", the fruits of temperate climates (apples, pears, etc.) predominate, though citrus fruits do well in the northern part; Tasmania is above all the apple orchard of Australia; South Australia grows more especially apples and almonds; and lastly Western Australia grows apples.

Average yields. — Average yields for each kind of fruit are obtained by dividing the official returns of production for each State by the number of trees in that State. The resulting figures are sometimes very low; in certain parts, especially in Western Australia, the area under fruit trees

has been more than doubled during the last seven years, with the result that many of the orchards are very young and yielding small crops ; besides this, many orchards are planted in unsuitable places by inexperienced townspeople and the poor returns from such orchards reduce the average yield for the State. In Table III are set out the average yields of various fruits in each State.

The average yield for apples varies from 22 lbs. to 46 lbs., being lowest in Queensland and highest in Victoria and New South Wales ; the yield in Tasmania is depressed by the fact that the trees are planted too close together in some of the old orchards ; Western Australia only averages 26 lbs. in spite of her eminently suitable climate.

Varieties grown. — Owing to the variable climatic conditions met with in the various States, the varieties grown are very numerous.

Apples (classed in order of importance).

Maiden's Blush	{ early, exported to Great Britain	Shepherds' Perfection (mid-season).
Duke of Clarence		Stone Pippin (late).
Pomme de Neige		Rymer (late).
* Dismarck		Schroeder (late).
King of the Pippins		Winter Strawberry (late).
Cox's Orange Pippin		* Rokewood (very late, keeps well in cold storage).
Scarlet Nonpareil (late)		Shorland Queen (early).
* Cleopatra (mid-season).		Canada Pippin (mid-season).
Jonathan.		Yates.
Sturmer's Pippin.		Kaiser Alexander.
French Crab (late).		Newmann's Seedling (late).
Dumelow.		Green Alfriston (early).
London Pippin or		* Granny Smith.
Three-crowned Pippin.		* Carrington (early).
Lime's Prince Albert (mid-season).		* Trivett (early, resistant to blight and a heavy cropper).
Statesman.		McIntosh Red (early).
Lord Suffolk (early).		Twenty Ounce Pippin.
* Stetwarts (late).		Warner's King (early).
Gravensteiner (mid-season).		Beauty of Bath (early).
Rome Beauty (late).		Lady Dely.
Esopus Spitzenberg (late).		* Dunn's Favourite or Munroe's Favourite.
Peasgood Nonsuch (early).		
Wealthy (mid-season).		

Pears.

Clapp's Favourite.	Winter Beurré d'Hardepont.
William's Bonchrétien.	Doyenne du Comice.
Beurré Superfin.	* Winter Cole.
Box's Bottling Pear.	Beurré Curé.
Beurré Diel.	Josephine de Maline.

* Of Australian origin.

Winter Nelis.
 Tongre.
 * Packhams' Triumph.
 Beurré d'Anjou.
 Conference.
 Howell.

Madame Cole (late).
 Keiffer (mid-season).
 Broom Park (late).
 Anna Nelis.
 Autumn Beurré Coloma.

Quinces.

Apple Shaped.
 Rea's Mammoth.
 Portugal.

Pear Shaped.
 Master's Early.

Apricots.

Royal.
 Moorpark.
 Tilton.
 Mansfield's Seedling.
 Hemskirke.

Shipley's Blenheim.
 Peach.
 Large Orange.
 Alsace.

Cherries (on wild Mazzard stock).

* Troyford- Hart (best of the earlies).
 Napoleon.
 Black Republican.
 Claremont.

Early Lyons.
 Florence.
 Noble.
 St. Margaret.

Peaches.

Champion.
 Lady Ingold.
 Admiral Dewey.
 Foster.
 Kia Ora.
 Riverside Elberta.
 California.
 Comet.
 Globe.
 Wiggins.

Nicholls Orange Cling.
 Philip Cling.
 Pullar's Cling.
 Briggess Red May.
 Early Albert.
 Early Louise.
 Elberta.
 Hains Early.
 Mountain Rose.

Plums.

Angelina Burdett.
 Belgian Purple.
 Belle de Septembre.
 Burbank.
 Kelsey.
 Kirkes.
 Coe's Golden Drop.
 Pond's Seedling.
 De Montfort.
 Prince Englebert.

Purple Gage.
 Washington.
 Clyman.
 Denniston's Superb.
 Diamond.
 Diaprée Rouge.
 Early Orleans.
 Evans Early.
 Green Gage.
 Jodoigne Green Gage.

October Green Gage.
 Oullins Golden Gage.
 Princess Alexandre.
 The Czar.
 Denbigh.
 Deneyer's Victoria.
 Grand Duke.

Imperiale de Milan.
 Jefferson.
 Late Black Orleans.
 Magum Bonum (white and red).
 Monarch.
 Pond's Seedling.

Almonds.

Brandes Jordan.
 Nonpareil.

Paper Shell.
 Sultana.

Walnuts.

Dwarf Proflic.

Santa Barbara.

Tangerines.

Emperor.
 Thorny.
 Beauty of Glen Retreat.

Parke's Special.
 Canton.
 Scarlet.

Oranges.

Washington Navel.
 Joppa.
 Parramatta.
 White Siletta.

Late Valencia.
 Thompson's Selected.
 Paterson's Seedling.

Lemons.

Lisbon.
 Lisbon Thornless.
 Sweet Rind.

Villa Franca.
 Genoa.

Bananas.

Cavendish.
 Lady's Finger.
 Plantain.

Sapientum.
 Giant Sugar.

Figs.

Adam.
 Blue Provence.
 Angelique Bordeaux.
 Black Turkey.

Brown Turkey.
 Black Genoa.
 Brown Ischia.
 Blue Ischia.

Red and White Currants.

Cherry.
 La Fertile.
 La Versailles.
 Red Dutch.
 Mammoth.

Red Imperial.
 White Dutch.
 White Transparent.
 White Imperial.

Black Currants.

Black Naples.
Carter's Black.
Champion.

Kentish Hero.
Lee's Prolific.
Ogden's Black Grape.

Gooseberries.

Red :

Billy Dean.
Crown Bob.
Ploughboy.
Prince Regent.
Conquering Hero.
Jolly Miner.
Keen's Seedling.
Overall.
Roaring Lion.
Lancashire Hero.
Lion's Provider.

Green :

Drill.
General Graham.
Gretna Green.
Green Gascoigne.
Greenwood.
Green Overall.
Heart of Oak
Keepsake.
Lord Crewe.
Nelson.
Peacock.

White :

Gill's Seedling.
Northern Hero.
White Muslin.
Thumper.
Waterloo.
Plunder.
Smiling Beauty.
Whitesmith.
White Lion.
White Eagle.

Yellow :

Dublin.
Goldfinder.
High Sheriff.
Leader.
Leveller.
Pretty Boy.
Rockwood.
Sulphur.
Trumpeter.
Yellow Lion.

Raspberries.

Antwerp Red.
Antwerp White.
Falstaff.
Northumberland Fillbasket.

Victoria.
Cuthbert.
Franconia.
Golden Queen.

Strawberries.

Annetta.
Aurie.
British Queen.
Captain.
Crescent Seedling.
Dr. More.
Melba.
Laxton's Noble.
Phenomenal.
Sir Harry Rawson.
Federation.

Glenfield Beauty.
Governor General.
Howcroft.
King Edward VII.
Marguerite.
Marshall.
Zena.
Lord Kitchener.
Trollope's Victoria.
Creswell.

Planting Fruit Trees. — Land may always be obtained from the Government on very favourable terms for the purpose of planting fruit, provided that the holder builds a house and lives on the land. Usually payment is made in twenty small annual instalments. Such land always consists of unbroken bush or forest, so that the formation of an orchard is a laborious matter; felled timber is unsaleable and has to be burned on the spot. Young trees are provided by the large Australian nurseries; they usually consist of pure varieties and are planted on the square or the quincunx method at the rate of 90 to 100 trees per acre. Trees come into bearing very early owing to the warm climate: apples, for instance, yield fair crops at five or six years old.

Cultivations. — The hot climate and the summer droughts, occurring just at fruiting time and lasting three, four, or even six months, necessitate repeated cultivations, which on the other hand are limited by the scarcity of labour. Immediately after the fruit has been gathered, the soil is ploughed deeply in order to absorb as much water as possible during the winter. A second ploughing is usually given at the end of July or beginning of August to destroy weeds, and during the summer the surface is kept stirred to prevent evaporation.

Manuring. — Most of the land under fruit is sufficiently fertile not to require manuring, but fruit has also been planted on some poorer soils where it soon became evident that the trees were being starved and consequently manuring had to be resorted to. Farmyard manure is rarely available, as the farmers only possess the bare number of horses required to work the holding and these are not often in the stable. In the neighbourhood of towns where it may be bought cheaply, dung is frequently employed; in other parts it is replaced by green manuring to make good the loss of humus, which decomposes rapidly owing to the hot climate. Green crops are only grown during the winter, as their drying effect would be bad during the summer; they consist almost entirely of leguminous crops, which do well in the cool winter months. Peas and vetches are chiefly employed; the orchard is cultivated in autumn (February-March) as soon as the fruit crop has been harvested, and seed is sown in April; in August the green crop flowers and is ploughed in. A few growers use forest leaf mould instead of a green crop where shallow cultivations are employed in order not to injure the roots of the fruit trees. Artificial manures are also in common use, especially bone flour or other phosphatic manures, because the soils while very rich in potash are exceptionally poor in phosphoric acid; a more complete manuring is becoming usual.

Irrigation. — Good returns are obtained by irrigating fruit orchards in Australia, and a fair proportion of the land under fruit is irrigated in spite of the undeveloped state of the country:

New South Wales	1 000 acres
Victoria	17 550 "
South Australia	3 600 "
Total	22 150 "

Victoria is justly called the Australian Irrigation State, though New South Wales completed in July 1913 a colossal dam which is to hold up almost as much water as the Assuan dam in Egypt, and to help to bring 40 000 acres under irrigation by means of a canal 240 miles long. At the present moment the Mildura district, Victoria (6 500 inhabitants), is the most important irrigation area. It is situated on the Murray and extends over 9 700 acres, having been founded in 1887 by the Chaffey Bros., who received large grants of land in Victoria and undertook to construct an irrigation system. At present the land is occupied by small holders; the holdings vary in size from 10 to 40 acres and the right to water goes with the land. Four pumps with a total capacity of 22 million gallons per minute raise the water 50 to 90 ft. above the level of the river; the irrigation works are administered by a committee elected from amongst the holders, which levies the water rate and regulates the distribution of the water; rates vary from 10s to £2 per acre. The pumps usually work for about 120 days per annum, providing one watering in winter, two following close on one another in the summer, and one in the autumn. The chief crops at Mildura are raisins, lemons and peaches.

Another important irrigation scheme, in this case belonging to the State of Victoria, is situated in the valley of the Goulburn, where reservoirs have already been constructed to hold 60 000 million gallons; others are planned to raise the total storage capacity to 360 000 million gallons, which will be sufficient to irrigate 750 000 acres. Small irrigation plants in the Doncaster district should also be noted; almost every holder has a tank at the top of his orchard into which water is pumped by means of a wind-mill or a petrol engine and from which the water is led in channels to all parts of the holding. The chief irrigation scheme in South Australia is at Renmarck, also on the Murray and on the same principle as Mildura, but of about one-third the size of the latter.

Management of trees. — Usually half-standards are planted; four to five or even nine main branches are trained in a cup shape, the centre of the tree being kept as open as possible; all secondary branches are kept short so that the fruit is formed close to the main branches which is said to facilitate the feeding of the fruit. Pruning varies with the different varieties, but the writer is inclined to think that it is always somewhat excessive, except in the case of lemon trees, where only the dead wood is cut out.

Enemies and their control. — Codling moth (*Carpocapsa pomonella*) causes serious damage to apples; lead arsenate washes are used against it as well as grease bands. American blight (*Schizoneura lanigera*) is also very prevalent; it is checked by means of paraffin emulsion washes. A disease known as "bitter pit" causes serious harm and is being investigated at the present time. Other parasites frequently met with are: red spider (*Tetranychus telarius*), San Jose scale (*Aspidiotus perniciosus*), peach leaf curl (*Exoascus deformans*), *Clasterosporium carpophilum*. Certain preventive measures are prescribed by law.

Fruit Trade. — All small fruit, as well as a large part of the citrus fruit, finds a market in the Australian towns. Apples, lemons and dried fruits

find an Australian market at certain times of the year but are also important export products, more especially in the case of apples; the development and extent of the apple trade is given in Table IV.

TABLE IV. — *Exports of apples in tons.*

State	1910	1911	1912
Western Australia.	198	281	1 163
South Australia	2 335	1 258	3 369
Victoria	2 935	5 303	5 447
Tasmania	10 320	12 824	14 669
New South Wales.	250	136	306
Total . . .	16 038	19 801	24 954

Apples are mostly sent to Great Britain, but also to Germany (about 180 000 barrels in 1912), the Far East, South Africa and South America. In the modern orchards only those varieties are grown which are suitable for export. The production is continually increasing so that it is constantly sought to improve the existing markets and to find new ones, a matter which should not prove difficult as the apples are of excellent quality and arrive in Europe from March to May, at a season when the home crop is already consumed; they consequently fetch good prices.

While the organisation of the export trade is excellent, that of the home trade is poor, especially with regard to marketing, so that the producers are sometimes completely in the hands of the town retail dealers and it frequently occurs that producers receive very little for their crops when the consumers are paying a high price.

Cost of planting and production. — Conditions are so variable that the data can only be given approximately. The cost of buying the land, clearing, cultivating, fencing, planting and management up to the time the trees are in full bearing is estimated at from £75 to £100 per acre. A twelve-year-old apple orchard should bring in £20 per acre per annum.

745 — **South American Fruit.** — *Boletín de la Unión Panamericana*, Vol. XXXVIII, No. 3, pp. 318-335. Washington, March 1914.

The writer describes the general conditions of fruit growing in South America and the possible developments of the industry in view of the variations of climate met with in the different parts of the continent and of the new transport facilities afforded by the opening of the Panama Canal. He points out the difference between fruit growing in North America, where deciduous trees prevail, and in South America, where the tropical and sub-tropical fruits are more general and native apples, pears, peaches and plums do not exist. Native fruits of South America are as follows:

Guava (*Psidium Guaiava*).

Custard apple (*Anona Cherimolia*).

Passion fruit (*Passiflora edulis*).

Spondias dulcis.

Prickly pear (*Opuntia* sp.)

Gomortega nitida Queule.

Murta murtella (*Myrtus Ugni* Molina), with berries very like the blueberry (*Vaccinium*).

Maqui (*Aristotelia Macqui*), sometimes mixed with grapes in the manufacture of wine.

Grapes, an unimportant variety found in the extreme north.

Capulli or Capolles (*Prunus salicifolia*), rather like the American wild cherry.

A few other kinds which are little known.

Very few of these fruits are given in the American Pomology and many are of little commercial importance, but there is every reason to believe that the usual commercial kinds can also be produced as many have already been successfully introduced: for example sapotas, mangoes, bread fruits, tamarinds, pomegranates, avocados (*Persea gratissima*), olives, figs, citrus fruits, are grown in sub-tropical regions, while the ordinary fruits of the United States are grown in the temperate regions.

In the Argentine the vine is the only fruit cultivated on a large scale, the vast plains of the region being little adapted to fruit growing; nevertheless, in the pampas, and especially in the neighbourhood of Buenos Ayres, some attention is now being paid to the matter. The so-called Tigre Islands at the mouth of the Paraña are famous for their peaches. Around Tucuman citrus fruits, especially oranges, are cultivated and the industry might well be developed with improved means of transport and better methods of packing. Regions in the province of Salta are well adapted to sub-tropical fruits, such as the custard apple and avocado, which are as yet only produced for local consumption. In the provinces of Neuquen and Rio Negro some wild apples occur, which, according to tradition, are descended from trees imported by the Jesuits and which still yield fruit of good quality. But the vine is the only fruit possessing any real commercial importance in Argentine at the present day; of late years its cultivation has greatly increased and proved very remunerative in the province of Mendoza; a well equipped school of viticulture has even been founded in Mendoza itself and is to be extended next year. The prosperity of the industry dates from the arrival in the district of some Italian vine growers. High quality table grapes are produced and the erection of a small refrigerating plant makes it seem likely that the Buenos Ayres market will soon be within reach. Other fruits cultivated on a small scale in the Mendoza and San Juan districts are peaches, nectarines, apricots and pears.

In Chili the general conditions are very similar to those prevailing in California and similar kinds and quality of fruit are produced, though the industry is much less developed in Chili; fruit of excellent quality and appearance is found on the markets of Valparaiso, Santiago and Concepcion. Between the Andes and Valparaiso, sub-tropical fruits such as avocado, custard-apple and papaya are found, though they are inferior in size and

quality to similar fruits produced in their native tropical habitat ; citrus fruits are cultivated in fairly large quantities in districts south of Santiago which are not subject to frosts, but are not abundant on the markets between January and April. As in the Argentine, grapes are the most important kind of fruit in Chili ; they are mostly employed for the manufacture of wines which are very popular in South America and are exported to Argentina in large quantities ; the wine-growing region extends from Santiago to Concepcion. In the south very good pears and apples are cultivated ; in fact the apples of Valdivia are renowned throughout Chili and important orchards are found near Angel, south of Concepcion. Further south is a wooded region rather similar to parts of the States of Oregon and Washington ; this southern region is frequently considered the most fertile in Chili, though very little has yet been done in the direction of bringing the land under cultivation except round Rio Buenos, where a German colony has completely transformed the neighbourhood.

Peru and Bolivia are quite in the tropical zone, though the altitude of certain regions modifies their climate. Those tropical fruits which are capable of resisting the somewhat primitive methods of transport are found on the Peruvian markets and are of excellent quality ; the grapes are good, but after transport are only fit for wine making ; from April to June, apples and peaches abound but these are not of first quality. Other fruits cultivated are oranges, bananas, avocados, custard-apples, sapota (to a height of 6500 ft.), guavas, "ciruela agria", "gravadilla" (*Passiflora ligularis*), "tumbo" (*Passiflora quadrangularis*), prickly pear (*Opuntia Tuna*) which is very abundant, and a kind of wild cherry with fruit about the size of Richmond cherries which is picked from wild trees in the Urubamba Valley (north of Cuzco) and marketed in May. The fertile soil and excellent climate in parts of both Peru and Bolivia should make it possible to increase the production of fruit very considerably ; it is at present much lower than it was several centuries ago before the Spanish occupation and the region only requires the restoration of the irrigation system in order to become once more productive. The period of ripening of the various fruits is as follows :

Apples. — March, or in rare cases January — February, to November.

Cherries. — November to February.

Peaches. — December to March.

Pears. — February to May.

Plums. — January to March.

Apricots. — December to February.

Grapes. — January to June.

Oranges. — September to December.

Lemons. — All the year round.

The fruits all mature at a time when the European and North American markets are without home supplies and would consequently fetch good prices ; land is cheaper in South than in North America, irrigation water is abundant, labour is not costly, soils and climate are eminently suitable for fruit

growing; consequently it is likely that transport difficulties will soon be met and that the four countries discussed above are destined to become important producers of fruit.

746 - **Influence of Different American Vine Stocks upon the Quantity and Quality of the Wines.** — FAES, H. and PORCHET, F. *Etude de l'influence de divers Porte-greffes sur la Qualité et la Quantité de la récolte.* Station viticole de Lausanne, 46 pp. Lausanne, 1914.

The Lausanne Vine-growing Station possesses in several parts of the Canton of Vaud, nine experiment vineyards, each about two-thirds of an acre in extent; they represent the most various conditions of soil and aspect; except for two which serve other purposes, each is divided into three portions. The first is planted with Chasselas Fendant grafted on various stocks; the second with direct-bearers (white and red) about which the results obtained have not yet been published; the third (which is kept as a check plot) is planted with European vines, especially Chasselas, on their own roots. The vines in these three portions are all of the same age, so that the influence of the stocks upon the wine can be freely studied in comparison with that produced by European vines upon their own roots. Each graft-bearing stock is represented by 80 or 100 specimens. The following have been tried: *Pure Americans* — Riparia Gloire de Montpellier and Rupestris du Lot; *Americo-Americans* — Rip. × Rup. 11 F., Duforer, 101-14, 3309 and 3306, Sol. × Rip. 1616, Berl. × Rip. 420 A., 157-11, 34 E., Rip. × Cord. - Rup. 106-8; *Franco-Americans* — Aramon × Rup. 1, Mourvèdre × Rup. 1202 and Chasselas × Berl. 41 B.

The yield of each stock of grafted vines is carefully recorded and the must is examined chemically. The experiments were continued from 1911 to 1913. The most important results are summarized as follows:

Among the pure American vines, Rupestris du Lot in general appears inferior to Riparia Gloire. The vines grafted on Rup. du Lot yielded a higher crop, marked by a lower sugar content, while the amount of acidity was frequently rather high; the quality and quantity were more satisfactory when the grafted vine was trained as a cordon (in one vineyard all the vines were thus treated). Rip. Gloire does not thrive equally well on all soils.

The group of Rip. × Rup. hybrids gave very uniform and good results and their yield was in general the highest of all stocks, the maximum being given by 3309; the next best was Rip. × Rup. 11 F., the third 101-14. In this group a normal connection between quality and quantity was observed, while Rup. du Lot, for instance, even with diminished quantity, yielded grapes of inferior quality.

Sol. × Rip. 1616 behaved very well during all three years. In two of the experimental vineyards it yielded the highest crops. The grapes in general are sweet and have a low acid content.

The vines grafted on Rip. × Berl. give, as is well known, a limited production during the first years; this was very clearly shown in 1911 in comparison with the hybrids Rip. × Rup. Of the former, No. 157-11 was, during the three years, the most productive, nevertheless the percentage of

sugar in the must was sufficient. In 1912 the difference in yield between the Berl. hybrids and those of Rip. \times Rup. was already less marked and in 1913 the yield of the former approached still more that of the other stocks. Excepting in one experimental vineyard 34 E gave lower yields; it was also less rich in sugar than 157-11. The writers do not yet pronounce definitively on the Teleki Rip. \times Berl. hybrids, which were only recently planted.

Rip. \times Cord. - Rup. 106-8 gave a satisfactory yield; in 1911 it bore more than the Rip. \times Berl. hybrids on the Franco-Americans.

In general the Franco-Americans during the three years, notwithstanding their vigorous development, yielded a crop lighter than and inferior in quality to that obtained by using as graft-bearers the less vigorous Rip. \times Rup. hybrids. Aramon \times Rupestris 1 and 1202 made no exception saving in two and one vineyards respectively, in which the compact and heavy soil seemed admirably suited to the Franco-Americans. But here also their yield did not come up to that of 3309. The sugar content in the grapes of these two common Franco-Americans did not show improvement in connection with the diminished quantity of yield. In comparing the two, it appears that 1202 often produced grapes with a higher acidity than Aramon \times Rupestris 1. Stock 41 B behaved very differently in the various vineyards, as regards both quality and quantity; nevertheless in some it was fairly successful. Cabernet \times Berlandieri (only recently planted in two vineyards) was not very productive and gave a must with too low a sugar content. The must of vines grafted on Vinifera \times Rupestris 84-3, which were also only recently planted, showed in 1912 and 1913 a minimum of sugar and a maximum of acidity.

From the observations made it appears that in general (there are some exceptions) the content in sugar diminishes or increases inversely to the bulk of crop, while with acidity the reserve is the case.

747 - **Experiments in Growing Vine Hybrids in Styria.** — MATIASIC, FR. in *Zeitschrift für Weinbau und Weinbehandlung*, Year I, Part 5, pp. 209-218. Berlin, May 1914.

In Styria a great portion of the vineyards have been reconstituted (32 000 acres up to 1912) on American stocks; in many localities, especially in the south, these suffer from chlorosis, so that some of the plantations gradually perish.

In order to ascertain which are the most suitable stocks for these difficult conditions, the soil often containing large quantities of lime, the Government established a nursery at Dvor in 1903; here the hybrid stocks recommended for calcareous soil are tested. This nursery consists of a plantation of stocks for multiplication, a nursery proper in which the cuttings, some of them grafted and some not, are set to root, and another nursery of stocks under observation in which the hybrids are tested as grafted stocks.

The soil of the nursery for multiplication purposes is partly on marl and partly stony and it contains from 63 to 72 per cent. of lime. The nursery is about 2 acres in extent and has 3301 mother plants belonging

to 45 varieties of hybrids. The writer divides these hybrids into three groups.

The first includes those which have always been free from chlorosis: Riparia-Cordifolia-Rupestris de Grasset 106-8, Berlandieri-Riparia 420 A, Aramon Ganzin 1 (it has to be defended against mildew), Chasselas-Berlandieri 41 B (it also has to be protected against mildew), Riparia-Monticola 1 R and Riparia-Rupestris. Their growth is very satisfactory (41 B is somewhat weaker) and the same may be said of the maturing of their canes; they are not susceptible to drought.

The second group contains the hybrids that are not immune from chlorosis but which from other points of view are still fairly satisfactory: Solonis-Riparia 1616, Mourvèdre-Rupestris 1202, Solonis-Rupestris, Berlandieri-Riparia 420 B and C, 33 and 34 E. M., Riparia-Berlandieri Teleki 4, 5, 6, 7, 8 and 9, Riparia-Berlandieri 157-11, Rupestris-Solonis 215-1 and 217-1, Riparia-Berlandieri 150-15, Pinot-Rupestris 1305, Rupestris-Berlandieri 301 A, Malbec Berlandieri 12, Taylor-Narbonne, Gamay-Couderc and Aramon-Riparia 143 B. The canes of all of them mature satisfactorily. Solonis-Rupestris and 1616 on their own roots at Dvor are not very resistant to phylloxera and consequently they are not to be considered as graft bearers. No. 1202, Gamay-Couderc, 1305, 143 B and 1 A suffer from mildew.

The third group embraces those hybrids which do not resist chlorosis, do not grow satisfactorily, or are somewhat susceptible to drought, and which consequently have been partly eliminated and replaced by better hybrids: Rupestris-Berlandieri 219 A, 220 A, 301 B and C, 301-37-152, Cabernet-Berlandieri 333, Cabernet-Rupestris 33 A (liable to mildew), Rupestris-Berlandieri Teleki 10 a, Riparia-Rupestris 3306-3309, 101 and 101-14, Colombeau-Riparia 2502 and Rupestris-Solonis Pecs. No. 101-14 was also eliminated as subject to phylloxera and suffering from frost. Nos. 219 A, 301 C, 301-37-152, 3309 and 333 developed to a very limited extent and produced only thin useless canes.

On the subject of the use of Riparia-Berlandieri-Teleki hybrids (4, 5, 6, 7, 8 and 9) no opinion can be formed until the new plants selected at Dvor have been tried. They are hybrids which represent a mixture of forms.

In the nursery, where the soil is a heavy loam, difficult to work, the cuttings, some of them grafted and others ungrafted, are set to root. Nos. 219 A, 301-37-152, 301 A, B and C, 3309 and 333 strike root in insufficient numbers, as in fact do all the hybrids of the third group. The others strike roots in the proportion of 50 per cent. and some even above 70 per cent.

In grafting, the successes attain as much as 63 per cent. In a grafting experiment carried out in 1910 with Hengel St. Severinus' grafting machine the same percentage of successes was scored as by hand grafting, but it was observed that in machine grafting the stock does not keep the scion so well as with hand grafting. In the percentage of successful grafts no difference was observed between those stocks which had been previously forced

in a greenhouse and those which had not been so treated. The lowest percentages of successes were those with Riparia-Monticola 1 R (20.2) Aramon-Ganzin (29.8), Riparia-Berlandieri (33) and Aramon-Rupestris 143 B (33.5).

The experimental nursery for grafted vines (1.04 acres) is situated on a highly calcareous soil (68 to 72 per cent. of carbonate of lime). It has been planted gradually since 1906. In this nursery the behaviour of each hybrid when grafted is different from that which it shows when ungrafted; for this reason the test of the various grafted hybrids is very important.

From 1906 to 1912 inclusive, 1270 vines, grafted on all the above-mentioned hybrids, were planted. Their development, notwithstanding all the care bestowed on them, cannot be said to be satisfactory. Chlorosis attacks more or less all the grafted stocks, so that it has already been necessary to uproot 521 of them on account of their excessive weakness (partly also on account of phylloxera in the case of Sol.-Rup 1616, 101-14 and 106-8). The vine "Grüner Sylvaner" suffers severely from chlorosis, especially on 1616, Aram.-Ganz. 106-8 and on the Teleki hybrids 6, 7, 8, 9 and 10a. This vine adapts itself badly to 1616, for during the six years that it has been grafted it has been sickly and has never yielded any crop. Grüner Sylvaner has hitherto succeeded only on Rip.-Mont. 1 R; Welsch Riesling succeeds well, that is without suffering too badly from chlorosis, on Aramon-Ganzin 1202, 420 A, 33 and 34 E. M. Solon.-Rup. and 1 R. Gutedel (Chasselas) planted in 1906 and 1907 is relatively healthy only on 1616 and on Aram.-Rup.; on 106-8 it has already become sickly. Weisser Burgunder (Pinot Blanc) planted in 1908 is of all scions employed the one which has been most successful on the hybrid stocks; on 1 R and 41 B it succeeds very well and on Aram.-Ganz. and on 1202 satisfactorily.

The productiveness of all these grafted stocks is very low.

Of the 45 hybrids which have been experimented upon, only those of the first group (and in this excluding 106-8 which does not resist the attacks of phylloxera) can be taken into consideration for soils as calcareous as those of Dvor. Nevertheless the experience gained at Dvor during ten years already allows the conclusion to be drawn that in such soils viticulture has not much chance of success even adopting these hybrids.

748 — **Self and Cross-Fertilization Experiments with Vines.** — GARD, M. in *Revue de Viticulture*, Year XXI, No. 1069, pp. 649-656. Paris, June 11, 1914.

Referring to previous work (I) an attempt is made to determine the relative importance of different methods of pollination in vines and the variation which occurs according to the nature of the vine and the general external conditions. Three methods of pollination are distinguished: 1) self-pollination; 2) pollination by another flower on the same plant and frequently on the same bunch; 3) cross-pollination. Flowers are of four kinds: a) those which do not open at all; b) those which open like ordinary phanerogamic flowers, the petals remaining attached to the floral receptacle; c) those which raise the corollary hood but do not push it right off (met with in certain natural and artificial hybrids, such as Croton, 117-4 Couderc,

(1) See No. 1430, B. Oct. 1912.

(Ed.).

Secretary, 150 Seibel, Concord, Jacquez, Black Hawk) ; and *d*) those which open in the normal way. In wild species numerous male plants exist and cross-pollination is the rule, the hermaphrodite plants having short, curved stamens and being self-sterile, while in the European cultivated vine there is a distinct tendency towards self-pollination.

Certain cultivated species also have short, curved stamens, which, at flowering time, rapidly grow out of reach of the stigma ; a number of such plants were selected and a bunch of grapes on each was freed from unopened flowers with the exception of a single bud left at the extremity of the bunch; this was enclosed in a bag and when about to open, the cap was lifted and pollen from two of the anthers was shaken over the stigma ; negative results were obtained in all the following cases : *Vitis cordifolia* (6 flowers), Black Eagle (4 flowers), Jacquez d'Aurelles (7 flowers), Blue Favourite (9 flowers), Massasoit (5 flowers), Catawba (1 flower). Some of the flowers fell off at once while others dried up gradually.

Whole bunches of the varieties Jacquez d'Aurelles and Blue Favourite were put into paper bags and showed that the flowers of a particular bunch were not inter-sterile. Castrated flowers of Jacquez d'Aurelles and Massasoit were also successfully fertilized by pollen from another bunch on the same plant. Fifteen castrated Massasoit flowers gave positive results with Black Eagle pollen.

749 - **The Cultivation of Olives in Tunis.** — GUILLOCHON, VERRY, TOURNIEROUX and ROBINET, in *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation*, Year XVIII, No. 77, pp. 268-296. Tunis, May 1914.

After a few historical notes on the cultivation of olives in Tunis, the writers discuss the various methods of propagation from seed, suckers, cuttings of different kinds and grafts. The number of cuttings to be obtained from a tree was determined ; two trees were chosen, both about a hundred years old ; one, with a solid trunk, produced 400 cuttings weighing about 1 lb. each, and the other, with a hollow trunk, produced 280 cuttings.

In Northern Tunis the olive groves are nearly all under the control of the Ghaba, which is an organisation founded to encourage the production of olives. The distribution of the groves in the various districts is as follows :

District	No. of olive trees
Gromballa	1 843 066
Tunis	1 026 704
Bizerte	476 631
Kef (including Tembourouk)	91 440
Beja (including Medjdez-el-Bab)	74 986
Maktar	72 303
Souk-el-Arba	83 798
Total	3 668 928

In Central Tunis the olive groves are found in a coastal belt about 56 miles long and from 2 ½ to 12 miles wide. The land is undulating

and those portions which are unsuitable for planting serve as catchment areas, being provided with trenches 2 to 6 ft. wide to lead the water into reservoirs. Groves may contain from 30 to 60 trees per acre. Their distribution in the various districts in 1913 was as follows:

District	No. of olive trees
Sousse	4 578 495
Kairouan	186 062
Tala	11 106
	<hr/> 4 775 663

In Southern Tunis the rainfall is very irregular so that plantations yield a less uncertain crop than annual plants and amongst trees the olive predominates. The following numbers existed in 1913:

District	No. of olive trees
Sfax	2 803 642
Gafsa	196 743
Gabes	65 588
Military circle	259 633
Total	<hr/> 3 325 606

Numerous varieties are grown, both for the production of oil and for pickling, the most prevalent of the former kind being the Chitouï and the Chemlali of Tunis and Sfax.

The cost of harvesting, which is done either by hand picking or by knocking the fruit off with a pole, varies from 10 to 12 fr. per "caffis" (5*d* to 7*d* per bushel) in a good year to 40 fr. (2*s* per bushel) in a bad year. In those groves under the control of the Ghaba, the olives are sold by auction; the owner then pays 20 per cent. and the buyer 3 per cent. of the sale price to the Ghaba for managing the grove; usually a net return of 4*d* to 10*d* is obtained per tree, but the crop is very uncertain and varied from 48 000 tons in 1911 to 5000 in 1910. In Central Tunis the yield is also very variable; from data obtained during five consecutive years it is estimated that a return of 5 or 6 per cent. should be obtained. In the south, olive trees under good management are estimated to produce:

at 8 years	$\frac{3}{4}$ to $\frac{1}{2}$	bushel per tree
» 10 »	$\frac{1}{2}$ to 1	» » »
» 15 »	1 to 3	» » »
» 25 »	3 to 5 and 7	» » »

The trees may be expected to maintain their yield for a considerable time under good management.

Oil extraction is carefully done in Tunis, and the oil is chiefly sold in France and Italy. The relative production of oil in the northern, central and southern regions respectively is about 1:1:4, the total production being as follows:

	Production in hectolitres (1 hl. = 22 galls.)	Value per kg. in frs.
1900	339 800	0.70
1901	265 200	0.70
1902	161 770	0.62
1903	392 500	0.62
1904	255 650	0.62
1905	244 800	0.62
1906	243 000	0.62
1907	392 900	0.60
1908	68 000	1.00
1909	420 000	1.00
1910	550 000	1.00
1911	420 000	1.00
1912	205 000	1.50
1913	345 000	1.50

Numerous parasites, both insect and fungoid, attack the olive trees in Tunis. The Government does a good deal to encourage the cultivation of olives; over and above the institution of the Ghaba, pruning competitions are held, and it is compulsory that all fallen fruit should be collected in order to check the propagation of the olive fly (*Dacus oleae*); further, all grafted olive trees are exempt from land tax (canoun) for fifteen years.

750 - **Avocados: *Persea gratissima* Gaert. and *Machilus glaucescens* Wight.** — RIVIÈRE, C., in *Journal d'Agriculture tropicale*, Year XIV, No. 135, pp. 132-137. Paris, May 31, 1914.

Machilus glaucescens is still somewhat unknown as a fruit tree. The fruit is not as large as that of the avocado, sometimes more drawn out, always green with somewhat oval and pointed seeds. The flesh is greenish and similar to the avocado in consistency and flavour. The tree is prolific, especially every alternate year, and more resistant to violent fluctuations of climate than the avocado. Its hardiness should make it very suitable as a stock for the avocado; methods of cultivation are identical for the two plants.

LIVE STOCK AND BREEDING.

751 - **Investigations on the Presence of Tubercle Bacilli in the Flesh, Blood, and Intermuscular Lymphatic Vessels of Tuberculous Calves.** — HABUTLE, CHR. in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten*, Vol. 74, Part 1-2, pp. 91-130. Jena, May 27, 1914.

HYGIENE

The writer made intraperitoneal injections into 161 guinea-pigs and 9 rabbits, with blood, muscular-serum, and serum obtained from the intermuscular lymphatic vessels of 36 more or less tuberculous calves, with a view to solving the question of the pathogenic power of bovine tuberculosis. The most important results may be summarized as follows:

1. In the case of fat calves suffering from severe tuberculous infection of the spleen, liver, kidneys, lungs and so-called lymphatic vessels of the flesh, no infection of the blood is as a rule discernible.

2. No tubercle bacilli can be discerned in the muscular tissue of tuberculous calves, even in those cases in which the lymphatic vessels immediately connected with it shew tuberculous lesions or swelling.

3. Tuberculous infection of the lymphatic vessels may be present, even if they exhibit no tuberculous lesions; and in the case of such fresh infection of the lymphatic vessels, still imperceptible macroscopically, the muscular tissue proves free from tubercle bacilli.

4. The macroscopically latent infection of the lymphatic vessels in a calf does not presuppose the infection of the blood by tubercle bacilli. The infection of these vessels must, in the absence of infection of the blood, be considered as communicated through the lymph ducts from other already infected vessels.

5. The mere swelling of a lymphatic vessel of the flesh is not invariably to be regarded as a definite indication of the infection of that vessel or of the muscular region connected with it, and in the same way the fact that a vessel retains its normal shape and size is no guarantee that it is free from tubercle bacilli.

FEEDS AND FEEDING

752 - The Importance of the Inorganic Constituents of Feeding Stuffs. -- ZAITSCHEK, A., in *Allatorosi Lapok*, Year 37, No. 19, p. 225. Budapest, May 9, 1914.

In collaboration with St. Weiser, the writer instituted investigations into the influence of the inorganic ingredients of foodstuffs on the development of bone in young pigs. The experiments shewed in the first place that when the animals were fed exclusively on maize, they excreted, in spite of putting on muscle, more calcium than they retained, and made up the deficit with magnesium. Later, when the quantity of dry food was raised somewhat (from 700 gms. to 918.9 gms. for example, in the case of a pig weighing 98 lbs.) and 5 gms. of calcium carbonate added to the maize food, the deficit in calcium was replaced by a heavy increase, the amount of magnesium retained falling at the same time from 0.5092 gm. to 0.1013 gm. Simultaneously the quantity of phosphoric acid retained rose from 13 per cent. to 30.1 per cent. When the pig, weighing 115 lbs. was fed on barley only, getting 900 gms. of barley and 160 of starch every day, a slight surplus of calcium resulted, which was not sufficient to ensure a corresponding development of bone. An addition of 3 gms. of calcium carbonate to the daily ration produced a high absorption of calcium and phosphoric acid.

As the minimum quantity of calcium required depends on a variety of circumstances, it cannot be definitely indicated in such a way as to admit of growing pigs being kept accurately balanced as regards calcium. In the experiments, a high absorption of calcium and phosphoric acid resulted when 10 or 11 gms. of calcium carbonate were added to the food per 100 kg. of live-weight. When young pigs were fed exclusively on maize, or maize and barley, the bones did not develop properly but seeing that both maize and barley contain phosphorus in sufficient quantity, it appears unnecessary to use the more expensive calcium phosphate in place of calcium carbonate. Pigs reared in the open usually pick up lime along

with earth, etc. and therefore under such circumstances it is superfluous to give them lime; but animals, and especially young fattening pigs, in the sty, cannot supply their requirements as regards lime, and the lack of it only too easily renders the fattening process unsuccessful.

753 - **Feeding Experiments with Lupin and Horse-Chestnut Flakes.** — HAUSEN, REISCH, EWALD and LILIENTAL in *Illustrierte Landwirtschaftliche Zeitung*, Year 34, Nos. 42 and 43, pp. 391-392 and 399-400. Berlin, May 27 and 30, 1914.

The writers conducted some feeding experiments with lupins and with horse chestnuts deprived of their bitter principles by a new German process (1) and rendered suitable for feeding purposes. They used only the flakes prepared from blue lupins and from horse chestnuts without any other admixture. The contents in nutritive matter which the writers compared with previous analyses by Bässler are the following:

	Lupin flakes		Horse-chestnut flakes per cent.
	Writers' analysis per cent.	Bässler's analysis per cent.	
Dry matter	82.0	91.4	85.0
Crude protein	25.7	27.7	6.7
Pure protein	22.9	—	5.1
Crude fats	4.0	2.1	3.9
Nitrogen free extract	36.3	42.6	67.8
Fibre.	9.1	11.2	3.5
Ash	7.2	7.7	3.2

The lupin flakes still had, as Bässler had also observed, a fairly bitter taste; their alkaloid content was 0.18 per cent.

If the coefficient of digestibility for disemibittered lupins and for horse chestnuts given in the literature on the subject be taken for these new flakes, they would contain the following amounts of digestible food:

	Dry matter per cent.	Crude protein per cent.	Fat per cent.	Carbo- hydrates + crude fibre per cent.	Protein per cent.	Starch value per cent.
Lupin flakes.	82.0	23.4	3.5	41.8	20.6	63.8
Chestnut flakes	86.0	4.0	3.3	63.0	2.4	72.4

(1) The process, invented by VON FEHRENTHEIL of Liegnitz, is described and illustrated by P. HOEPFNER in *Illustrierte Landw. Zeitung*, No. 6, 1912.

(2) See *Landwirtschaftliche Wochenschrift für Pommern*, p. 12, 1911.

Lupin flakes are therefore a food rich in protein and chestnut flakes in starch.

The animals experimented upon were cows and sheep; it was intended to feed them with both kinds of flakes, but the cows refused the lupins on account of their bitter taste and so only chestnuts were given to them.

I. *Fattening lambs with lupin flakes.* — The animals experimented upon were 24 yearling lambs divided into two equal groups. The first group was fed a basal ration of meadow hay, mangolds and barley groats, and as food for purposes of comparison 0.4 lb. of bean groats and earthenut meal per 100 lbs. live-weight. The second group got the same basal ration plus 1.1 lb. of lupin flakes per 100 lbs. live-weight. The experiment proceeded without any noteworthy incident, the lupin flakes being eaten up readily. The result was as follows :

	Group I lbs.	Group II lbs.
Increase per animal in 73 days	28.82	28.38
» » per day	0.396	0.389
Carcase weight in percentage of live weight	47.9	47.9

The lupin flakes thus had the same nutritive effect as a corresponding quantity of nutriment given under the form of beans and earthenut cake.

II. *Fattening lambs with chestnut flakes.* — In this experiment 24 Hampshire lambs were employed; they also were divided into two equal groups, the first of which was fed a basal ration consisting of meadow hay, dried beet slices and soy bean meal, and, for comparison with the chestnuts flakes, 1.1 lb. of wheat bran and 0.66 lb. of maize per 100 lbs. live-weight. The second group received the same basal ration and 2.64 lbs. of chestnut flakes per 100 lbs. live-weight. During the whole time the chestnut flakes were readily eaten, and notwithstanding the large amount fed, did not affect the health of the animals. The following are the results :

	Group I lbs.	Group II lbs.
Increase of weight per animal in 73 days	24.42	15.84
» » » per day	0.33	0.22
Carcase weight in percentage of live weight	48.8	45.6

According to the opinion of the butcher the lambs of the first group were not perfectly fattened, but still fat enough and provided with sufficient tender meat, while the lambs fed on chestnut flakes were thin and their flesh was soft and watery. On the whole the chestnut flakes proved unsatisfactory.

III. *Experiments with chestnut flakes for milch-cattle.* — Four cows were fed a basal ration consisting of hay, dry beet slices and soy bean meal and, during three periods, 0.8 to 3 lbs. of maize groats and 2 lbs. of wheat bran per 1000 lbs. live-weight, in comparison with 2 lbs. of chestnut flakes, fed during one period and 4 lbs. of the same flakes fed

during another one, always per 1000 lbs. live-weight. The experiment proceeded without any hitch and after the first three days the cows ate their chestnut flakes readily enough. These flakes however had the drawback, that during the fortnight during which 4 lbs. of them were given all the cows suffered from scour. The same happened when at the end of the tests the flakes that remained were fed to all the cows in the experimental herd. On the milk yield the chestnut flakes did not seem to have any effect, favourable or unfavourable, from which it appears that in doses up to 2 lbs. per 1000 lbs. live-weight, they can be freely fed to cows.

From the above experiments the writers conclude that while the preparation of these flakes is certainly interesting, the difficulties attendant upon their use render it doubtful whether it will be profitable to go on producing them.

754 - **Breeding Ardenne Horses in Sweden.** - ABRAMSON, ERIK. Pp. 14, Köping, 1914.

HORSES,
ASSES AND
MULES

Ardenne horses began to be bred in Sweden in 1873, when Count Wrangel imported into Värmland two Belgian Ardenne stallions. The results obtained were so satisfactory that after a few years Count Wrangel imported 18 pure bred stallions and 14 mares. By the early eighties the importations of Ardenne horses into Southern and Central Sweden had become almost general. The crosses between Ardenne stallions and the native mares were more satisfactory than the native horse improved by Norwegian and thoroughbred blood. It was especially in Västergötland that the breeding of Ardenne horses reached a high degree of perfection. About the middle and towards the end of the eighties other breeds, such as Clydesdales, Shires, Percherons and Pinzgauers were used for crossing, but about the middle of the nineties it was clearly recognized in Sweden that on the whole the most suitable horse for the country was the Ardenne.

Since then the breeding of Ardenne horses in Sweden, assisted also by the State, has continued to develop. Up to 1900 the distribution of prizes by the State was almost exclusively for outward conformation, but since then the value of pedigree has been recognized. From this reorganization of the standards for the distribution of prizes the consolidation of the breeding of Ardenne horses in Sweden may be said to date. A further encouragement was the foundation of the Studbook Society for Swedish Ardenne horses with the assistance of the State and of the agricultural associations. It published a studbook for the whole country, in which only the Ardenne horses recognized by the State Committee for prizes are admitted. Up to 1913 inclusive, 4631 horses, 680 of which are stallions, have been entered.

In Sweden, besides the Ardenne horses, which are the most important, another breed of heavy draught horses is raised in the most northern provinces. These breeds are kept separate and serve different purposes. The Ardenne horse is employed in farm work and the smaller draught horse of the north is in demand for work in the forests. To a small extent Clydesdales are also bred.

The State and the agricultural societies spend yearly about £17 600 under the form of prizes for the encouragement of the breeding of draught horses which is for the most part carried out by the peasants. The stallions belong exclusively to associations formed for the purpose or to private owners. In Sweden there are only very few stud farms for Ardenne horses, those of Blomberg in Västergötland and of Bjärka-Säby in Östergötland being the best known.

The importation of Ardenne horses from Belgium is limited at present to only the best breeding animals for which not infrequently from £550 to £825 are paid for stallions and £165 to £220 for mares. In general in Sweden it is not the largest and heaviest Ardenne horse that is bred, but a medium-sized one combining strength, resistance and agility.

CATTLE

755 - **Experiments on the Profitable Feeding of Milch-Cows.** — GOLDSCHMIDT, H. (Royal Veterinary and Agricultural College, Copenhagen) in *Dansk Land*, Year 1, December number, pp. 453-470. Copenhagen, 1913. (Summarised by the writer).

This experiment is a kind of continuation of previous feeding experiments. These latter aimed partly at a comparison between the effect, that is the economical result, of a ration composed according to the usual empirical rules and that of another composed, with due consideration to the amount of nitrogenous and nitrogen-free matter in the different foods, in a manner proportional to the yield of milk of the different cows; the experiments were also carried out to demonstrate that the so-called equivalents ("Ersatzzahlen"), the use of which during the last decades has spread greatly in Scandinavia and other countries, cannot be used alone when it is a question of compounding profitable rations for milch-cows, though they may perhaps be useful in the calculation of the money value of the food. Besides, these experiments serve to detect some errors in the feeding of cattle, as for instance using straw *ad libitum*.

The present experiment, which takes, lucerne as basal ration, is to be considered as a preliminary one; especially as lucerne is still of relatively recent introduction in Denmark.

In the experiment two groups of ten milch cows each were employed. At first, during the period of observation, the cows were fed exclusively on lucerne *ad libitum*. It appeared in this period, among other things, that the weight and performance of the individual cows did not stand in any approximatively constant relation to the quantity of lucerne consumed, and that the older and drier the lucerne, the less of it was eaten.

In the experimental period which followed the observation period the cows of both groups were given 77 lbs. of lucerne and 2.2 lbs. of straw; but while Group I received also 1.02 lb. of oilcake (containing protein) for every 10 lbs. of milk, Group II received a quantity of oats corresponding to the equivalent figures (Ersatzzahlen), namely 1.33 lb. for every 10 lbs. of milk. These rations were fed for the first 25 days, after which, for the remaining 20 days of the experiment, Group I was fed oats and Group II oilcake.

In both groups oilcake produced the greatest yield of milk. If the equivalent numbers had been correct, under the above mentioned condi-

tions the two concentrated foods should have had the same effect upon the production of milk.

That the addition of oilcake to a forage so rich in protein as lucerne was able to cause a relatively greater increase in the milk yield than the oats is due not only to the fact that the content of digestible protein in the lucerne (77 lbs.) was not large enough without further addition to cover the want of this substance, but also to the fact that the relatively large amount of nitrogen-free matter contained in the oats was not capable of balancing the comparatively low content of protein in this food. or, in other words: the above result shows that it is comparatively easy to force the yield of milk by the use of protein at the expense of the fat contained in the body, when the cows are in good condition (which was the case in this experiment), while it is difficult to do so with carbohydrates at the expense of the protein-containing tissues of the body.

According to the calculations which have been made on the basis of the analyses of the foods employed in the experiment and according to the quantities of milk obtained and the weights observed (test milkings were made daily and the cows were weighed every 5 days,) the following conclusions were drawn :

1. Lucerne alone can only exceptionally and temporarily afford a profitable food for milch cows.

2. Lucerne combined with other food is one of the best fodders for milch cows. In proper proportions lucerne is admirably suited to increasing the profitableness of cattle keeping.

3. Under the given conditions, when it was a question of compounding an economical ration for cows in excellent condition, the addition of oilcake, to a limited quantity of lucerne (77 lbs.) was more favourable to the yield of milk than a corresponding quantity of oats (on the basis of equivalents).

The results of the experiment show further that the substitution of foods rich in protein by those rich in carbohydrates may produce exactly the same milk yield without justifying the conclusion that in any particular case one food can effectively replace a corresponding quantity of the other food. This observation has long since and repeatedly been made by the writer.

On the basis of these results and the considerations to which they give rise a series of general rules may be established for the use of lucerne during the various periods in summer.

1. As long as the lucerne is young, that is up to about the 15 th. of June, it is to be supplemented by mangolds (or if necessary cereals, etc.).

2. From the 15th. of June to about the 15th. of August lucerne, being older, is to be fed with oilcakes, or, if it is fed in smaller rations, with oilcake and cereals, etc.

3. From the 15th. of August to about the 10th. of September lucerne, should be supplemented by oilcake and mangolds.

The report contains a number of suggestions for mixtures of varying quantities of lucerne with several other foods.

FIGS

756 - Investigations into the Metabolism and the Potential Energy of Foods in Growing Pigs. — FINGERLING, KÖHLER, REINHARDT, BRETSCH, ARNDT and DIETRICH in *Die Landwirtschaftlichen Versuchsstationen*, Vol. 86, Parts 3 and 4, pp. 149-230. Berlin, May 25, 1914.

These experiments are a continuation of those of Kellner on the utilization of pure foodstuffs by ruminants. The method followed differed somewhat from Kellner's: the two animals under experiment were given, in a preparatory period, a basal ration consisting of a mixture of barley groats, meat meal, phosphate of lime ("Futterkalk") and common salt. In the following period, pig. no. 1 was given successively, besides the basal ration, potato starch, earthnut oil, "strohstoff" (straw cellulose, obtained by boiling straw under pressure in an alkaline medium) and gluten; pig no. 2 was given meat meal (0.66 lb.) and sugar. Lastly both pigs were fed the basal ration again, the same in quantity and quality as at the beginning of the experiment. The different periods lasted 13 to 14 days (some only 12) and the observations made during this time dealt with the metabolism and consumption of energy, from which the utilization of the food given was calculated.

The result of these investigations demonstrated that pigs utilize the productive parts of food to a greater extent than is the case with ruminants. When the individual foods are given separately in an easily digestible form, as in gluten meal, starch meal, earthnut oil, "strohstoff" and sugar, their higher utilization by pigs as compared with the same by mature cattle is as follows:

Gluten protein	35.1 per cent.
Fat	31.8 » »
Carbohydrates	30.0 » »
Crude fibre	0.0 » »
Sugar	32.1 » »

With the exception of digestible crude fibre, which is not more utilized by pigs than by cattle, the better utilization of the different foods attains nearly the same value. It appears thus that Kellner's starch values, which are only relative figures, may be used also for calculating the rations of pigs, all the more as crude fibre has only a secondary importance in the rations usually given to pigs.

POULTRY

757 - Rearing Ostriches in Madagascar. — *Bulletin de l'Office colonial du Ministère des Colonies*, Year VII, No. 76, pp. 189-200. Melun, April 1914.

The ostrich farm at Tuléar made satisfactory progress during 1912 and another is being established at Befamany. The diet of lucerne has proved very healthy for the birds whose plumage has considerably improved, the tail feathers of the male birds fetching as much as 36 s per lb. Anthrax has accounted for a good many deaths and it is suggested that the anthrax organism is able to live in the body of the ostrich as a saprophyte, becoming pathogenic when the general health of the bird is bad; the fact that large numbers of the organism are found in the body of ostriches who have died after excessive exercise, lends support to this hypothesis.

758 - **Mulberry Leaves Preserved in Cold Storage.** — BUFFA, P., 8 pp. Riccardo Biontina, 1914.

SILKWORM

More than a ton of mulberry leaves were distributed in 39 boxes made of zinc or wood and in various sizes; the boxes were closed and kept in cold storage at a temperature of 2° C. (35.6° F.) from June to August, after which they were used to rear silkworms and compared with fresh leaves for that purpose. Atmospheric conditions were most unfavourable throughout the experiment.

From the results obtained the following conclusions were drawn:

1. Large quantities of mulberry leaves can be preserved by means of cold storage.
2. The temperature of the storage chamber should be constant between 1° and 2° C. (33.8 and 35.6° F.).
3. It is better to precool the leaves for a few hours before putting them into the storage chamber.
4. The containing boxes should not be of greater capacity than 3 cu. ft. (holding 56 lbs. of leaves) and should be packed in the chamber in such a way as to allow free ventilation in all parts.
5. Stored leaves were eaten with as much relish by the silkworms as fresh leaves and gave equally good results with regard to both the worms and the cocoons produced.
6. The cost of storing the leaves in a chamber of 4200 cu. ft. capacity amounted to 1s 9d per cwt.

759 - **Sericultural Products in Persia.** — LAFONT, F. in *Bulletin mensuel de l'Office des Renseignements agricoles*, Year XIII, No. 4, pp. 418-420. Paris, April 1914.

The trade in silkworm eggs in Persia is practically entirely in the hands of Greek merchants who obtain nearly all their grain from abroad. There are, however, a few isolated breeders in Persia and a certain amount of unselected grain is also produced and sold fraudulently as imported selected grain. Imports during the past 8 years are given in the following table.

Imports of grain in ounces of 25 gms. (= 0.88 oz. avoirdupois).

1905-1906	242 413
1906-1907	346 202
1907-1908	398 156
1908-1909	—
1909-1910	322 246
1910-1911	308 782
1911-1912	372 640
1912-1913	280 000

Four-fifths of the imports come from Turkey, and the rest from Russia, while insignificant amounts are obtained from France and Italy, the importation of grain from western countries being impeded by local prejudice. The eggs are usually sold on credit the cash price being about 4s per oz. of 25 gms.

There are no statistics as to the production of cocoons in Persia, but this is estimated at 5950 tons of raw material per annum. This low production is due to defective rearing methods and to the poor quality of the eggs which are frequently diseased. The cocoons are of poor quality and fetch 7d to 8 ½d per lb. in the raw state; they are chiefly exported to France and Italy; those not exported are worked up by the cultivators themselves, who only have very primitive apparatus at their disposal and turn out a rough, faulty, dull tissue which would be unsaleable in Europe; the best qualities are worth 8s 6d to 9s 3d per lb. according to the state of the European market. Not more than about 120 tons of waste is produced per annum, best quality floss fetching about 1s 6d per lb. at Constantinople.

It would certainly be more profitable to export the silk in the form of good reeled silk than in the form of cocoons and there would seem to be an opening for European reeling mills in Guilan, Mazanderan, and Khorassan. The present production would require about 20 000 modern reeling units. The chief obstacle to the establishment of such mills is the mussulman customs which prevent men from entering the workshop where women are working, consequently preventing proper superintendence of the work.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

760 - New Implements used at the Flahult Experiment Farm, Sweden, in the Year 1913. — AKERBERG, H. in *Svenska Mosskultur/förningens Tidskrift*, Year XXVIII. No. 2, pp. 147-154 + 7 figs. Jönköping, March 1914.

At the Flahult Experiment Farm the following implements were tested last year: a dung spreader, a Swedish lime and artificial manure spreader, a combined field leveller (Ackerschleife) and spring tooth harrow, a rotary harrow and three different ploughs.

The *dung spreader* is built for one horse and consists of a cart with a moveable bottom, which, like an endless chain, carries the dung towards the back of the cart, where a distributor scatters it in a finely divided state behind on the same principle as that adopted by the large manure spreaders of the International Harvester Co. The width over which the manure is spread is 4 feet. One man and one horse working 10 hours can manure from 1 ¼ to 1 ½ acres a day at the rate of 8 tons to the acre. The machine is therefore suitable for small farms. The work done was excellent with both large and small quantities of peatmoss dung.

The "*Albion*" artificial manure spreader, which is built chiefly for spreading pulverized lime, was used for basic slag and potash salts. The work done was satisfactory, but attention had always to be paid to the speed at which the machine was driven, as this influences the quantity distributed. When the weather was damp the spreading was not so good. Further experiments with superphosphate showed that this fertilizer cannot be spread with the machine, as it is liable to choke it.

The *field leveller and spring-tooth harrow* "Svensk" was tried on a fen and on sandy soil, but with no great success, as the soil was too loose. On heavier and firmer soil it appears to work better.

The *rotary harrow* "Hankmo" from Finland resembles Wassiss' spade harrow, but differs from it in that the axles are adjustable and the spades are replaced by narrow, pointed, slightly curved blades. This harrow was tried on moor and fen land, as well as on sandy soils; it was used on ploughed land, stubble and after beets, and every where worked satisfactorily. On old, stiff, unbroken meadows the soil was rendered fit for sowing by going over it twice with the Hankmo and once with a smoothing harrow. It requires considerable draught in consideration of the width of work done.

The *swing ploughs* Reval 1 and Reval 2, built by the Swedish Norra-hammar works, for Russian moor soils, were used on moor and fen land. No. 1. proved very useful for cultivating and for breaking up old stiff tussocky meadows. No. 2, was not so good for moor soils.

The third *plough* tried, the "Victoria", was built on the American Albion type. The specimen tried had been specially modified for moor soils. On old compact moors the performance was satisfactory; for loose, imperfectly decomposed or wet moors it is not so suitable. On mineral soils it worked admirably.

761 - *Tile-Drain Trench-Digger*. — *Engineering*, Vol. XCVII, No. 2525, p. 708. London, May 22, 1914.

In countries where irrigation is recent, as in America, South Africa, etc., the tendency has been rather to neglect drainage, with the frequent result of waterlogged soil and a consequent falling off in the crops.

Where the tracts of land are large and labour scarce, drainage presents difficulties, which tend to the mechanical treatment of the problem. Thus the mechanical excavator has been adapted to this kind of work. The accompanying figure illustrates a successful form of tile drain ditcher built by the Austin Drainage Excavator Co., of Chicago, U. S.

It is constructed to travel over soft ground. Eighty-five per cent of the 5 ½ tons that the machine weighs is supported by an endless chain of flat feet on each side and at one end of the machine. The pressure per square foot on the ground is only 390 lbs. The other supporting wheels are of the usual broad-tyred pattern and they are not near the trenching operations.

The trench is cut by a series of scoops or buckets, with lips of forged steel, attached to an endless chain and carried by a ladder or boom which is hinged at one end to a vertical frame, on an extension of which pass the cables for adjusting the height of the ladder.

The buckets can easily be fixed or removed from the chain. They are made three sizes: 10, 12 and 15 inches, which, with side cutters, secure trench widths of 12, 15 and 17 in. respectively. The buckets are cleaned of their contents by a strong fixed scraper which clears clay as effectively as light soil. The material brought up is delivered by the belt of a conveyor to one side of the trench.

The ditcher can excavate to a depth of 6 ft. according to the position of the ladder.

For usual conditions, making a cut 10 to 15 in. in width, 6 ft. deep and advancing at the rate of 15 ft. per minute, a two-cylinder 14 to 16 HP petrol engine is mounted on the machine. Steam power can be applied if preferred. It is self-propelling and moves on roads at 1 ½ to 3 miles an hour. It can turn in its own length.

It is estimated that the cost of running under normal conditions in the United States, including repairs, is less than \$10 per 10-hour day. Large sized ditchers cut trenches up to 40 in. wide and 12 ft. deep.

762 - **Spring-tooth Cultivator.** — From Report of Patents, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 18-19, p. 164. Vienna, March 21, 1914.

The novelty in the cultivator recently patented in Germany in Class 45 a, under Number 60 999, consists in the flat spring teeth being laterally twisted in their lower extremity (see fig. 1). By this means the teeth can, according as they are raised or lowered and turned inwards or outwards, increase or diminish the heights of the ridges and adapt themselves to any form of ridge or bed and distance of rows. In the framework *a* are fixed two pivot, *b* round which square axles *cc'* can turn. The spring teeth *dd* are fixed to the axles by clamps *ff*; a connecting rod *i* unites the levers, *hh'* attached to the axles *cc*. The lever *h'* is lengthened to an adjustable hand lever *h''*. The position of the wheels *n* can also be regulated as to height and width of gauge. Each of the spring teeth can be so shifted as to correspond to the shape of the ridge to be worked (see fig. 2), while the depth to which the teeth penetrate into the soil is regulated by turning the axles *cc*.

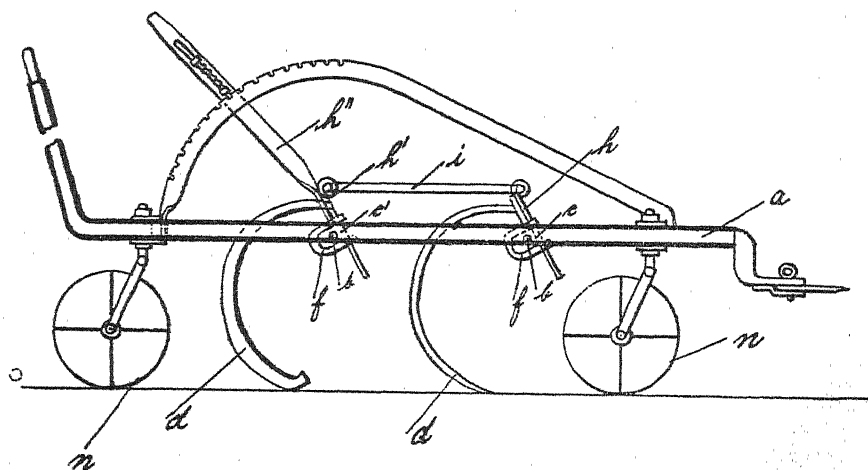
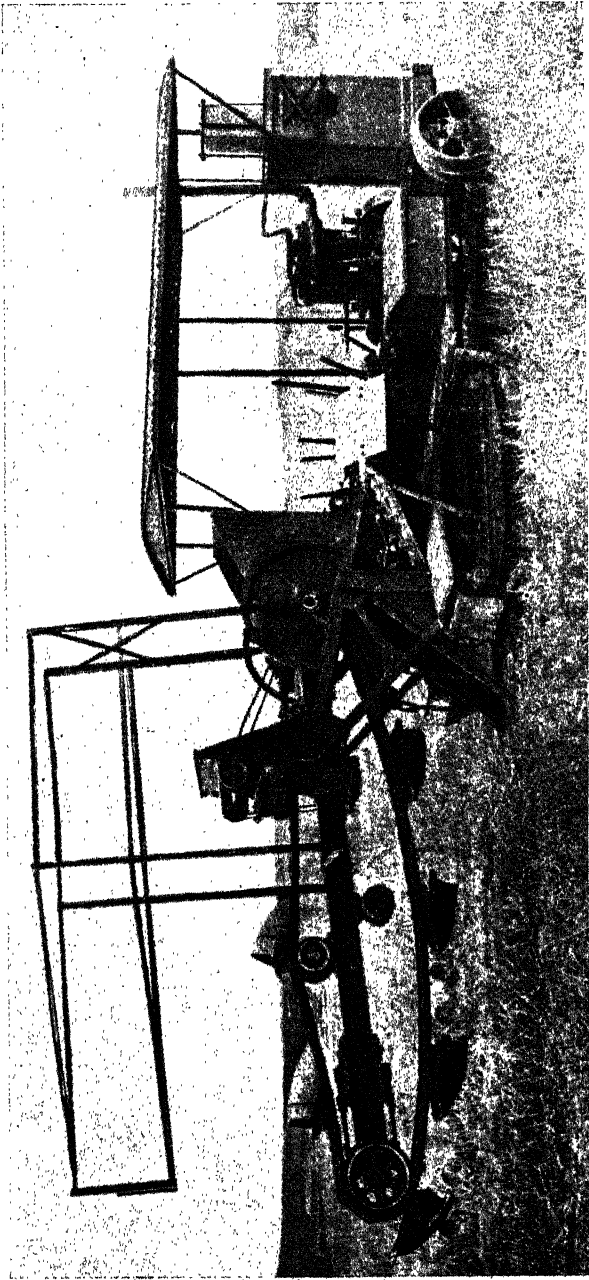


Fig. 1. — Spring-tooth cultivator (side elevation).



Tile-drain trench-digger made by the Austin Drainage Excavator Co., Chicago, U. S. A.

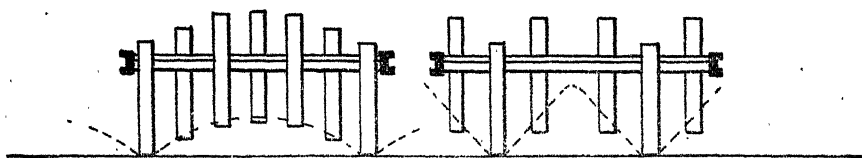
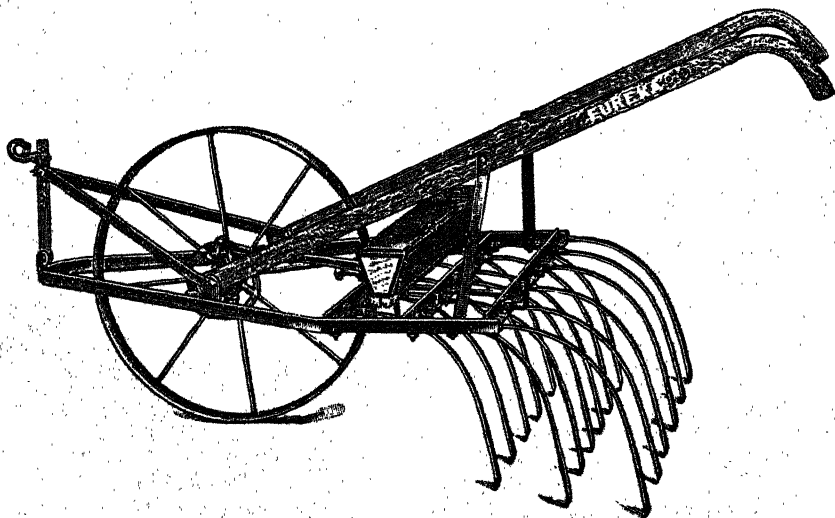


Fig. 2. — Spring-tooth cultivator, showing adaptation of teeth to ridges.

763 — **A New Mulcher and Seeder.** — *Farm Implement News*, Vol. XXXV, No. 16, p. 32. Chicago, Ill., April 16, 1914.

The new three-foot mulcher and seeder shown in the accompanying figure has lately been placed on the market. It is described as a mulcher, smoothing harrow, surface cultivator, seed sower and weeder, all in one. It enables farmers to sow grass seeds or grain between rows of other plants. The teeth cover the seed perfectly and level the ground. One horse only is needed.



A new mulcher and seeder.

764 — **Combined Horse-Hoe and Roll for Beets.** — *Blätter für Zuckerrübenbau*, Year XXI, No. 10, p. 161 + 3 figs. Berlin, May 31, 1914.

This device is patented in Germany under No. 267 840. It allows of several rows of beets being hoed and rolled at the same time.

The rollers and the hoes work independently of each other and can adjust themselves to inequalities of the field, being attached by separate arms, *b* and *d* (see fig. 1, side view, and fig. 2, plan), to the frame, *a*, of

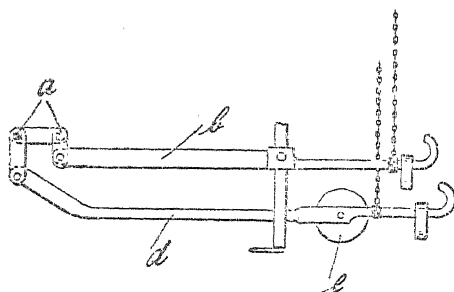


Fig. 1. — Combined horse-hoe and roll for beets (side elevation).

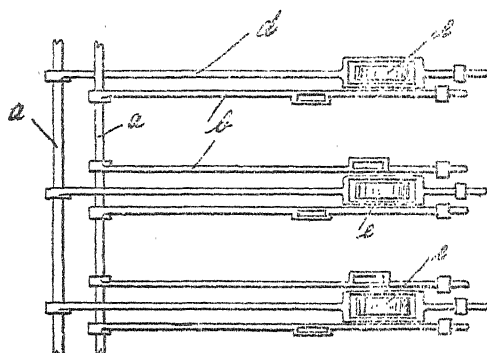
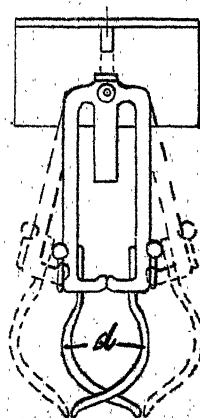
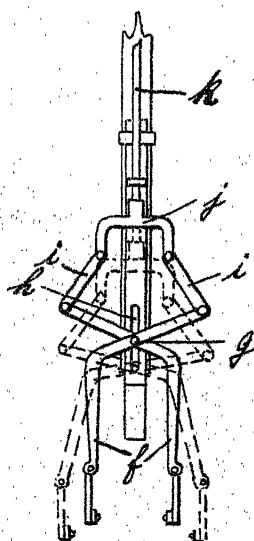
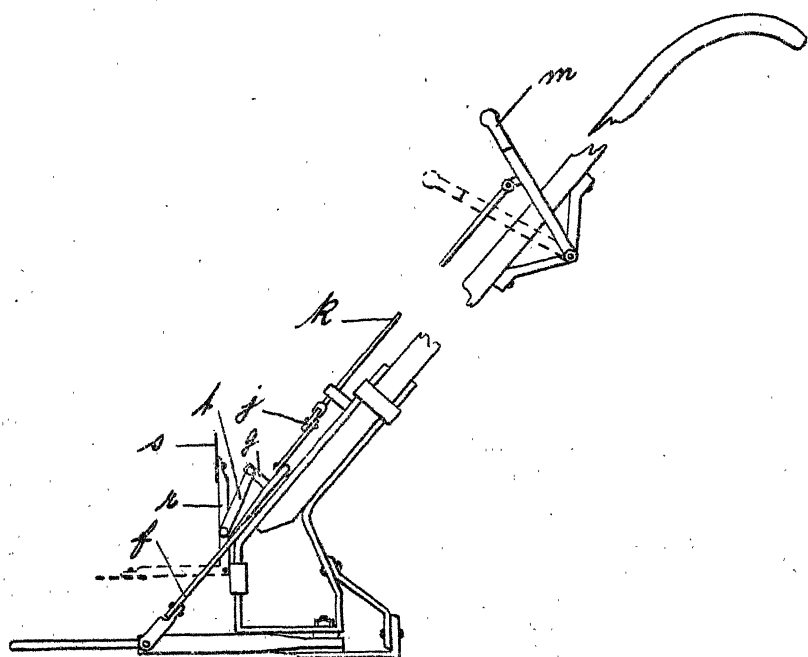


Fig. 2. — Combined horse-hoe and roll for beets (plan).

the machine. In heavy soils both hoes and rollers are provided with weights (*j*). The machine is fitted with steering gear fore and aft, so as to ensure the greatest precision of work.

765 — **Hand Beet-Lifter.** — *Blätter für Zuckerrübenbau*, Year XXI, No. 8, p. 129 + 3 figs. Berlin, April 30, 1914.

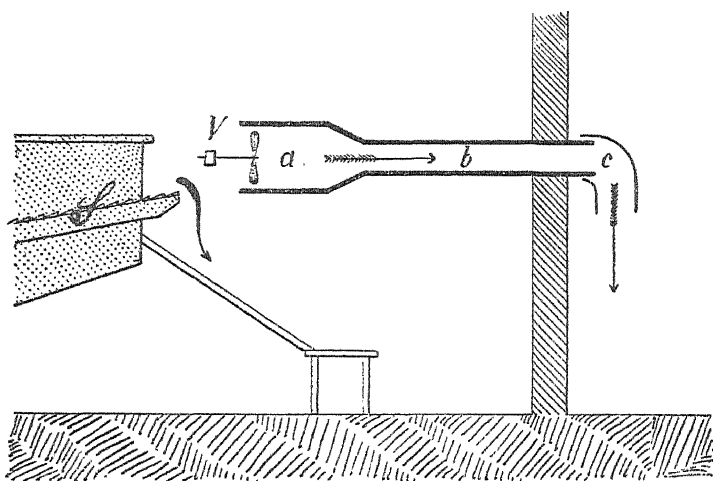
The hand beet-lifter shown in figs. 1, 2 and 3 is patented in Germany under No. 267 230. It lifts and tops at the same time; the cutting blade is fixed by an articulated joint to the rest of the implement in such a way that it assumes a position parallel to the jaws when these are open and turns up when they are closed. For opening and shutting the claws and lifting and lowering the blade *s*, the hand-lever, *m*, is used. It acts upon the connecting rod, *k*, a cross piece, *j*, the joint, *i*, and the claws, *f*, the bolt, *g*, of which works in a slot, *h*.



Hand beet-lifter.

766 - **Apparatus for Removing Dust while Threshing.** — DUVAL, CH. in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 20, p. 624, Paris, May 14, 1914.

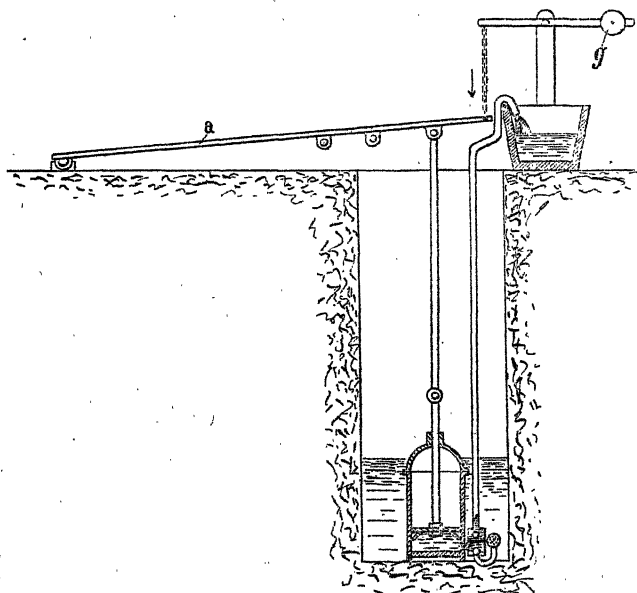
The accompanying figure is a sketch of an apparatus used for several years by the writer to remove dust while threshing. The screw-fan, *V*, rotating in front of the shakers, leads the dust into the pipes *a*, *b*, as shown by the arrows. The diameter of the fan and of the pipe *a* is about 40 inches, while that of the pipe *b* is only 24 inches. The moveable bent pipe, *c*, allows the action of the wind to be counteracted. The main pipe is about 15 ft. long and the dust can be driven a distance of 40 ft. The cost of the apparatus is from £16 to £20.



Apparatus for removing dust while threshing.

767 - **Pump for Watering Cattle worked by the Animals themselves.** — HINRICHS, in *Deutsche Landwirtschaftliche Presse*, Year XL I, No. 40, p. 500, Berlin, May 20, 1914.

This apparatus is designed with the object of saving the labour of pumping up water into the drinking troughs of pastures not provided with running water. The accompanying figure shows a section of the apparatus. The animal on mounting on the platform, *a*, starts the pump, which raises a certain amount of water. The counterweight, *g*, lifts the platform into its original position when the animal leaves it. A fence is placed round the apparatus to prevent its being used by more than one animal at a time.



Pump for watering cattle worked by the animals themselves.

768 - Review of Patents.

Tillage Machines and Implements.

Austria

- 65 192. Implement for removing weeds and the like from beet fields.
- 65 386. Motorplough which can be used as a lorry or power engine.
- 65 582. Clod-crusher.
- 65 584. Turn wrest plough.

Belgium
Canada

- 264 420. Beetroot hoe.
- 152 930. Gang plough.
- 152 969. Garden weeder.
- 152 982. Motor plough.
- 153 047. Land drag.
- 153 079. Pulverizer, planter and weeder.
- 153 081. Hoe and plough.
- 153 103. Rolling drum plough.
- 153 145. Land roller.
- 153 165. Cultivator and weeder.
- 153 180. Weeder for harrows.
- 153 194. Plough beam.
- 153 268. Weeder.

France

- 464 996. Motor plough.
- 465 079. Machines for hoeing and singling beets.
- 465 650. Rotary subsoil digger.
- 466 103. System for fixing the moveable point of the plough.
- 466 287. Apparatus for anchoring tillage machines, driven by portable engines, and advancing automatically as the work proceeds.

- 466 490. Ploughshare with reversible edge.
 466 754. Hoeing and singling machine for horse or motor traction.
 466 841. Knead cultivator tooth.
 466 855. Jointed ridging plough.
- Germany 272 760. Motorplough, the front end of whose frame can be raised or lowered on the front wheel.
 272 819. Screw for ditching plough.
 272 844. Apparatus for driving ploughs by electromotor.
 272 787. Driving wheel with movable projecting cleats, for agricultural machines.
 272 877. Disk harrow with adjustable counter pressure disk.
 272 879. Plough with device for ploughing in green manure.
 272 947. Motorplough with one driving wheel.
 273 289. Two-furrow turnwrest plough with one plough on each side of the beam, thus balancing each other.
 273 377. Depth and inclination adjusting device for Flemish turnwrest ploughs.
- Hungary 62 384. Motor rotary digging machine.
 62 399. New cultivator.
 62 448. Hoeing and ridging plough.
 62 470. Gang plough.
 62 503. Harrow.
 62 521. Motor gang plough with reversible motion.
 62 562. Self contained motor plough.
 62 604. Rotary cultivator.
 63 069. Rotary tilling machine.
 63 119. Driving wheel for agricultural machine, with cleats worked by an excentric.
 63 207. Device for raising or lowering plough shares.
 63 275. Weeding rake.
 63 341. Horse hoe.
 63 382. Steering gear for motor cultivator.
- Italy 149 464. Device for balance ploughs to protect the headlands.
- Switzerland 63 945. Toothed tilling machine.
 64 397. Ploughs.
 65 063. Motor fore carriage for ploughs in which the frame is beneath the axle of the side wheels.
 65 064 and 65 065. Machines for tilling the soil.
- United Kingdom 28 234 and 28 288. Rotary power cultivators.
 28 391. Cultivator.
 28 861. Hoe blades for rotary hoe.
 29 210. Hand rakes.
 29 729. Agricultural ploughs.
 29 812. Digging machines.
 29 967. Cultivators.
 303. Motor cultivators.
- United States 1 091 358. Cultivator.
 1 091 273. Revolving harrow.
 1 091 131. Zig-zag harrow.
 1 091 031. Subsoiler.
 1 090 935. Steering wheel for ploughs.
 1 091 681. Implement adjusting device for cultivators and the like.

- 1 091 712. Hand cultivator.
- 1 092 632. Rotary plough.
- 1 092 249. Disk harrow.
- 1 093 421. Steering device for cultivators.
- 1 093 786. Weed destroyer.
- 1 094 201. Land roller or pulverizer.
- 1 094 240. Plough.
- 1 094 277. Motor plough and planter.
- 1 094 196. Orchard plough.

Manure distributors.

- Belgium 264 236. Mixing barrel for diluting and distributing cow dung.
- Germany 272 948. Ratchet wheel and pawl drive for manure spreader.
- Hungary 62 483. Manure distributor.
- 62 837. Liquid manure spreader.
- Switzerland 65 293. Liquid manure cart.
- United States 1 091 163. Fertilizer distributing attachment.
- 1 093 826 and 1 093 928. Fertilizer distributors.

Drills and sowing machines.

- Austria 65 387. Potato planter.
- 65 581. Device for drills with sliding disks.
- 65 583. Dibbling mechanism.
- Belgium 263 848. Beet drills.
- Canada 153 280. Grain drill.
- 153 301. Corn-hill marker.
- France 466 098. Sowing machine.
- 466 525. Drill.
- Germany 273 171. Potato planter in which the potatoes are taken out of the hopper by revolving forks.
- 273 172. Sowing machine with unmoveable agitator wheels.
- 273 001. Tubes for potato planters.
- 273 291. Potato planter.
- 273 378. Potato planter with several tubes each with two slides.
- Hungary 62 383. Improvements in dibbling machines.
- 62 441. Potato planter.
- 62 688. Seed pickling machine.
- Italy 139 156. Drill.
- Switzerland 65 469. Seeding apparatus with agitator wheels.
- United Kingdom 28 290 and 29 967. Seed drills.
- United States 1 091 068. Attachment for corn planters.
- 1 092 007. Marker mechanism for corn planters.
- 1 092 030. Corn planter.
- 1 092 358. Seeder attachment for gang and sulky ploughs.
- 1 093 991. Planting machine.
- 1 093 938. Transportable potato hole digging machine.

Reapers, mowers, etc.

- Austria 65 774. Machine for hammering the blades of scythes.
- Belgium 263 445 and 263 446. Attachment for mowers for arranging clover and other grasses in regular windrows.
- 263 684. Lawn mower with cutter-bar.

- Canada 153 006-7 and 153 073. Harvester mechanisms.
 153 127. Harvester,
 153 132. Sheaf-loader.
 153 229. Harvester machine.
 153 250. Lawn trimmer.
 153 284. Lawn mower.
 153 302. Stacker mechanism.
 153 333. Grain carrier.
- France 465 150. Improvement in the cutter-bar of mowers and reapers.
 466 298. Improvement in side delivery rakes convertible into tedders.
- Hungary 62 496. Hay fork with wooden tines.
- Italy 139 867. Device for mowers to prevent the knives from blocking.
- Switzerland 63 947. Mower with reaping attachment.
 63 948. Cutter-bar for mowers.
 64 398. Machine for hammering scythes.
- United Kingdom 28 578. Scythes.
 29 497. Harvesting machine.
- United States 1 091 064. Hay rake and stacker.
 1 091 105. Knife arrester for mowers or binders.
 1 091 109. Corn topper.
 1 091 747. Corn harvester.
 1 091 779. Heading attachment for Kafir corn harvesters.
 1 092 721. Harvester.
 1 092 356. Grain stooker.
 1 092 722. Mowing attachment for motor vehicles.
 1 093 108. Harvesters for beans and the like.
 1 093 109. Kafir corn topper.
 1 093 742. Header and header binder.
 1 093 906. Shock-forming attachment for grain binders.

Machines for lifting root-crops.

- Belgium 263 443. Improvements in toppers and lifters for beets and other roots grown in rows.
 263 480. Toppers for beets and other roots.
- Canada 153 281. Potato digger.
- France 464 872. Beet topper and lifter.
- Germany 272 820. Potato harvester with tilting scoops.
- Hungary 62 403. Beet topper.
 62 495. Steering gear for beet-root lifters.
 62 663. Potato lifter.
 62 950. Root lifting machine.
 63 377. Beet lifter.
- United States 1 090 871. Beet harvesters.
 1 091 823. Beet topper and digger.
 1 092 216. Beet harvester.

Threshing and winnowing machines.

- Austria 65 630. Device to prevent the straw from winding round the cylinder in threshing machines.
- Belgium 263 042. Improved hand threshing machine for all cereals.
- Canada 153 054. Threshing machine.
- France 465 904. Straw elevator for threshing machine.

- 466 566. Group of machines for threshing and cleaning wheat.
 467 058. Attachment for threshers to direct the straw or sheaf elevators.
 Germany 273 198. Threshing machine with feed parallel to beater.
 273 490. Self feeder for threshing machine.
 Italy 134 812. Shaker with large screen for threshing machines.
 139 357. Automatic device for counting sacks or measures for threshing,
 winnowing machines etc.
 140 085. Straw elevator.
 Switzerland 63 949. Dust-removing apparatus for agricultural machines and especially
 threshing machines.
 United States 1 092 222. Threshing machine screen.
 1 092 356. Grain stooker.
 1 093 853. Grain separator.

Other agricultural machines and implements.

- Austria 65 191. Tree felling and cutting machine.
 65 269. Wheel especially for agricultural machines.
 65 388. Turning and raking device for tedders and potato lifters.
 65 772. Apparatus for watering live stock.
 Belgium 263 285. Improved root-cutter.
 263 491. Potato peeler.
 263 572. Improvement in liquid manure pumps.
 263 840. Centrifugal water purifier.
 263 975. Filter for rain water.
 Canada 153 091. Driving device for agricultural machines.
 153 120. Device for extracting traction wheels from holes.
 153 123. Stacker.
 153 195. Well drilling machine.
 153 252 and 153 290. Cattle guards.
 153 286. Rake cleaner.
 France 464 965. Fore-carriage for agricultural machines of all kinds.
 464 983. Machine for composing buttons for marking animals.
 464 999. Improvement in milking machines.
 465 098. Double portable fodder press.
 465 148. Device for untying animals in stables.
 465 475. Traction sprayer.
 465 867. Metal dismountable anti-hail rocket with safety device.
 465 892. Apparatus for sulphuring vines and fruit trees.
 466 249. Portable forcing bed built of reinforced concrete plates without
 angle uprights.
 466 289. Leaf fender for beet root lifter.
 466 579. Machine for removing outer bark for control of insects, etc.
 466 770. Apparatus for destruction of injurious animals.
 Germany 272 626. Appliance for use in manger.
 273 003. Machine for shelling nuts.
 273 005. Automatic lamp trap for insects with separate illuminating
 and catching surfaces.
 273 151. Protective screen for chaff cutters.
 272 999. Beet singling and potato lifting machine with throw wheel.
 273 492. Vertical milk separator with vessel for skim milk.
 273 199. Chaff cutting machine with device for automatic sharpening of
 knives while working.

- 273 489. Cherry stoning machine.
 Hungary 62 402. Agricultural tractor.
 62 527. Combined rake and elevator for straw, hay etc.
 62 577. Hay knife.
 62 606. Cleats for motor wheels.
 62 855. Wheel for raising and lowering agricultural machines.
 62 954. Chaff cutter.
 62 981. Ladder stay for fruit picking.
 62 982. Machine sprayer.
 63 030. Dust removing apparatus for agricultural machines especially threshers.
 63 093. Machine for untying sheaves.
 63 336. Appliance for cleaning fruit, seeds etc.
 Italy 137 826. Device for untying animals.
 139 153. Sliding support for needle with elastic safety clutch for hay and straw balers.
 139 259. Wine pomace press with upward motion.
 139 261. Machine for extracting, at the same time, the essential oil and the juice of lemons, oranges etc.
 139 353. Pyramid-shaped continuous feed cereal esiccator.
 139 954. Improvement in hand sulphur dusting machines.
 139 961. Machine for husking dried chestnuts.
 139 719. Grape crusher.
 139 796. Fork for agricultural and industrial purposes.
 139 938. Soil injector.
 140 162. Double flower pot with compensating reservoir, porous inner wall and impermeable outside.
 140 254. System of protection against hail.
 139 598. Syringe for injecting liquids into cheeses while pickling.
 140 043. Machine for peeling chestnuts.
 140 171. Apparatus for peeling scalded almonds.
 Switzerland 63 950. Apparatus for fumigating trees, etc. for control of pests.
 63 951. Process and apparatus for removing honey combs from hives.
 64 006. Apparatus for concentrating milk and other emulsions by filtration.
 64 007. Apparatus for washing and removing stones from wheat and other grain.
 64 008. Process and apparatus for grading and cleaning groats, grains, etc. by static electricity.
 64 139. Grape cutting device.
 64 140. Honey separator.
 64 401. Sulphur duster.
 64 472. Milk separator.
 64 647. Window with device for catching insects.
 64 869. Animal dipping device.
 65 341. Appliance for suction milking machines.
 65 533. Milk sterilizer.
 65 666. Bee feeding box.
 65 725. Improved milking machine.
 United Kingdom 28 527. Spraying machines.
 28 576. Machine for trimming plants and cultivating soil.
 28 584. Decorticating machines for Landolphia.

- 28 609. Apparatus for heating, cooling and drying grain.
- 28 657. Fruit stoning appliances.
- 28 671. Apparatus for pasteurizing milk.
- 29 009. Agricultural forks, welding etc.
- 29 123. Nut cracking machinery.
- 29 224. Cleaning sacks.
- 29 248. Cow milkers.
- 29 331. Apparatus for expressing liquids from fruits, herbs, flowers, etc.
- 29 369. Indiarubber coagulating apparatus.
- 29 635. Appliance for stoning cherries.
- 29 641. Apparatus for roasting, panning and drying tea.
- 29 648. Process of preparing peat as food for animals.
- 29 726. Lawn sprinklers.
- 30 067. Cow milkers actuated by the animal itself.
- 386. Extraction presses.
- 586. Potato peeling machines.
- 752. Agricultural syringes for injecting liquid manures, insect destroyers beneath the surface of the ground.
- 849. Apparatus for coagulating rubber latex.
- 916. Incubators.
- United States 1 091 371. Attachment for wind driven pumps.
- 1 091 401. Spraying pump.
- 1 091 296. Bale tying mechanism.
- 1 090 860. Cranberry harvester.
- 1 091 952. Spraying machine.
- 1 091 587. Draught appliance for farming implements.
- 1 091 974. Milking machine.
- 1 091 990. Adjustable tongue.
- 1 091 912. Hay press.
- 1 092 376. Steering truck for traction engines.
- 1 092 762. Cotton harvester.
- 1 093 488. Draught tongues for agricultural machines.
- 1 092 865. Spraying device.
- 1 093 862. Wind mill.
- 1 093 904. Silo.

RURAL, ECONOMICS.

769 - **The Statistical Method and its Value for the Economics of Farming.** — SAGAWE, B. in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 1, pp. 116-136. Jena, 1914.

In the first part of his work the writer discusses the different ways of collecting and working up material in the statistical and in the monographical methods and their advantages and disadvantages for showing the connection between causes and effects in general; he then passes on to the question as to which method is to be preferred and comes to the conclusions that in the study of productive farms (*Erwerbswirtschaften*), only by a combination of the two methods can the connection between causes and effects be estimated quantitatively and qualitatively in a reliable way.

In the second part of his work the writer treats of the importance of statistics in rural economy and of their application to research in this field.

The writer attempts by means of an example, to find out how far the several methods of isolating any particular factor to be examined attain their object, and analyses the effect of increasing intensity of culture upon the net returns. In this connection he examines: 1) an individual farm which, in the course of several years, evolved from extensive to intensive cultivation; 2) several variously organized farms during the same periods of time; 3) abundant material arranged according to the statistical point of view.

With the first method the period of observation, considering the variability of the weather and the consequent oscillation in the crops, must be extended to about 20 years. Then the most important factors to be considered are: position as regards means of communication, condition of prices, quality of the soil, capacity of the manager, which by their variation in the course of time render it almost wholly impossible to isolate completely the influence of the intensity of cultivation. When such is the case the result cannot be utilized as a term of comparison. The direction of the effect of individual factors can be recognized by separate monographs, but as soon as their quantitative effect is to be determined the method fails. The comparative monographic method encounters first of all the difficulty of finding suitable objects of comparison, for if even the so-called involuntary factors of production are fairly equal and comparable with each other, on the other hand it is impossible to eliminate the influence of the voluntary factor, the manager of the farm. Consequently it will also be impossible to attain correct numerical conclusions. The comparison of individual farms may afford a general view of the effect of the various factors, but in order to calculate with precision their influence and to obtain comparable figures available in practice, the formation of groups must be resorted to, that is to say the statistical arrangement of the data.

The use of the statistical method presupposes the existence of abundant material. But even not very abundant material can be utilized statistically, because with suitable methods of compensation a relatively large number of groups can be formed. In conclusion, the writer shows by a practical example how the isolation of a factor can be carried out under some circumstances without forming sub-groups. He calculates the effect of the increasing intensity of cultivation on net returns in 88 farms affiliated to the book-keeping office of the D. L. G. (German Agricultural Society).

In the formation of groups connected with each other, according to the compensation method of Prof. Mitscherlich of Königsberg, all the factors are fairly compensated with the exception of that of soil quality. The writer calculates the effect of the varying quality of the soil upon net returns, and basing his calculations upon the difference between the net returns obtained in this way and those obtained by grouping the farms according to the increasing intensity of cultivation, he shows the influence of this factor upon net returns.

770 — **Principles of Exact Investigations in Agriculture.** — VON KOPPEN, WILHELM
in *Archiv für exacte Wirtschaftsforschung*, Supplement 13, 88 pp. Jena, 1914.

After giving some general information on the importance of agricultural bookkeeping and on the difference between the bookkeeping of financial institutions and of commercial firms, the writer treats with more detail the notion of "net returns", about which a certain confusion has often been made between the means and the end; in defining it also the technique of some particular method of bookkeeping has been too frequently used, instead of explaining the result of calculations. A general definition of net returns must satisfy all methods of bookkeeping. The writer proposes the following: "Net returns are the numerical expression of the economic result of a farm free from debts."

Every system of agricultural bookkeeping which calculates net returns in such a way that they correspond to this definition must be considered systematic.

The most valuable system of bookkeeping is that which answers best to the requirement of the farm manager and to the character of the farm. The writer considers the systematic opening of accounts as the simplest and surest way of recognizing the direction and organisation of the farm. Systematic bookkeeping or bookkeeping by double entry must first of all show the various branches of the farm in such a way as to allow of the sufficient examination of each branch-organ and to recognize its function towards the other branches and towards the whole farm — the organism. Lastly bookkeeping by double entry must allow the cost of production to be exactly determined.

The system of bookkeeping introduced by the writer in his farm is called by him farm bookkeeping by groups. In his method the ledger is arranged under the form of accounts, with an auxiliary book in the form of tables.

The divisions of the whole farm into a small number of groups of accounts avoids the danger of totally separating the various production branches from the complex of the whole farm and renders the examination of each branch and of the reciprocal connection between them easier. On the other hand the decomposition of each group of accounts according to the system of tables by means of auxiliary annexes allows of a very detailed division of the farm and of the grouping together of the similar items of accounts, in view of a very minute control, of systematic calculations and of statistical observations, without causing the slightest perturbation in the whole of the farm.

In the bookkeeping by groups adopted by the writer the agricultural production is divided into two groups only: crops and productive stock. The utilization of the soil (crops) is considered as a whole. It is the same with the maintenance of productive live stock, which includes milch cows, young cattle and foals, as well as pigs and sheep if kept. Against these two accounts of production are placed the expenditure accounts, chief among which is that for labour, comprising all the labour expenses. Among the items of outlay there are the produce that is consumed and

general expenses. The first contains all the stores bought in, so far as a control over the remaining stock appears necessary. All the other expenses are found together in the general expenses account, which may be subdivided again as required. Lastly there are the inventories and the closing accounts.

The prices given to the produce sold are the market prices, upon which are based those of the produce consumed in the farms itself. In order to take into due consideration the rise and fall of the market prices, the writer uses a table of calculations relating to the produce of all kinds consumed on the farm. This table is an indispensable auxiliary in bookkeeping by groups, and it must be posted up every four weeks so as to follow closely the changes in market prices. Besides the prices, the quantities also must be carefully determined.

Of course, as in all bookkeeping, the accounts begin by an inventory and balance-sheet containing all the necessary information on the assets and liabilities. The items concurring in an increase of capital are entered as follows: The cultivable soil, having a lasting value, is inventoried at its cost price; permanent improvements likewise, while improvements possessing only a temporary duration are written off proportionately to their duration. The farm produce utilized in the farm itself, for instance timber for building purposes, is entered at the sale price obtainable at the farm. New plantations of trees are treated according to the same principle as cultivable land. The cost of the work of preparing the land for the crops, such as sowing, the seeds sown and the manures, must also appear in the inventory; only when an inventory contains these data can the profitability of the various crops and the cost of their production be ascertained.

Following upon this somewhat general discussion, the writer explains how he deals in the inventory with the various assets and liabilities, such as soil, forests, fruit plantations, improvements, roads, buildings, machinery, live and dead stock, cash, credits and debts, etc.

After entering these various values in the inventory, they are grouped together in the balance sheet and the total capital is worked out. The ledger is opened on the basis of the balance sheet. For technical reasons it is advisable to open the accounts of the ledger only at the end of the year. During the course of the year the farmer can limit himself to the entering of all business and farming events in chronological order in his memorandum book and to drawing up his table of stores every four weeks. The memorandum books must group the figures as they are to be used in the ledger.

The writer distinguishes two kinds of memorandum books:

A. Those referring to business transactions.

B. Those dealing with the work in the farm itself. The first group includes: the business journal with cash book, the labour book, the petty cash book, etc. as well as the current account book.

The second group includes the farm day book, with forage and milk tables as auxiliaires, the stores and livestock account, and the principal labour book.

At the end of the year the inventory has to be posted up to date and the closing balance sheet prepared, but it cannot be closed until the value of the stores and of the work put in the ground for the standing crops has been determined.

The next steps are to close the memorandum books, to start the ledger accounts and to close : 1) the auxiliary accounts, 2) the cash and inventory accounts, 3) the general expenses accounts, 4) the stores and 5) the labour accounts. After this, production accounts proper are closed. The first of these is the crop account, which must be divided into two parts : "production" and "utilization". Then comes the productive stock account and last of all the forest account.

After this there remain the other auxiliary and closing accounts : 6) the household and personal expense account, 7) the profit and loss account, and 8) the capital account.

771 - **Giving Farm Labourers a Personal Interest in their Work.** — SCHULZE GEORG, in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, No. 1, pp. 44-88. Berlin, 1914.

An enquiry was made into the means adopted on a number of large farms for giving all hired labourers as well as managers a personal interest in their work. Such means will naturally differ according to the nature of the work involved, but take the general form of payment by piecework and of bonuses in the case of stockmen. The writer discusses the advantages of large holdings in many styles of farming and the possibilities of adding to these advantages that personal interest in the work which is such an important factor in obtaining the best results. A bibliography is appended, together with a copy of the question form sent to the farmers.

772 - **Piece-Work in German Farming.** — ESDEN-TEMPSKI K., in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 3, pp. 455-498. Berlin, 1914.

The object of this paper is to illustrate the principles followed in fixing payment of piece-work in farms. For this purpose wages in kind must be considered as well as wages in cash.

Farms in Germany employ three kinds of labourers.

1. Labourers under permanent engagements.
2. Labourers under temporary engagements.
3. Casual labourers.

The first two classes get respectively two-thirds and one-third of their wages, in kind and the rest in cash, while the third class is paid only in cash. Assuming that for work of the same value the total wages are the same, the payment in cash is lowest for the permanent hands, somewhat higher for the temporary ones and highest of all for the casual labourers.

In practice this arrangement leads to the result that those labourers who should have the greatest interest in the prosperity of the farm get the least profit from piece-work, while the other two classes are better paid.

That such is the case is proved by a practical examples. On a farm in the province of Brandenburg the wages per day in summer are the following :

Permanent labourers	8d
Temporary "	1s 1d
Casual "	2s 0d

Usually the wages of the casual labourers or strangers are considered as the price of labour in the locality. Assuming such to be the case, namely that the men get a daily total wage of 2s then the value of the wages in kind per day is:

Permanent labourers	1s 4d
Temporary "	11d
Casual "	—

In this farm the payment of piece-work is fixed according to the wages in cash. Taking the daily wages at 8d, 1s 1d and 2s as the piece-work payment of one day's work, then the earnings of the three classes of labourers, 1) at daily wages, 2) at piece-work pay doing twice as much work, and 3) at piece-work doing three times as much work (all calculated for 140 summer days) work out as follows:

	I Daily wages			II Piece-work doing twice as much work			III Piece-work doing three times as much work		
	£	s	d	£	s	d	£	s	d
Permanent labourers:									
in cash	4	16	1	9	12	2	14	8	3
in kind	8	18	5	8	18	5	8	18	5
Total earnings	13	14	6	18	10	7	23	6	8
Temporary labourers:									
in cash	7	11	0	15	1	11	22	12	11
in kind	6	3	6	6	3	6	6	3	6
Total earnings	13	14	6	21	5	5	28	16	5
Casual labourers:									
in cash, total earnings,	13	14	6	27 ^a	9	0	41	3	6

The casual labourer has thus an advantage over the permanent labourer in case II of £8 18s 4d and in case III of £17 16s 8d. His greater profit in case II is equal to the value of the payment in kind that the more permanent labourer receives and which is not considered in the piecework payment of the latter. Every further increase in the amount of work done is so much more profit to the casual labourer. This signifies that the piece-work wages of the permanent labourers, even when he is, as capable as the casual labourer, are always inferior to those of the latter and to a less extent to those of the temporary labourer.

If instead of taking only the wages in cash as a basis for the payment of piece-work, the total of cash and kind were taken, all three classes of labourers would be paid on the same basis of *2s per diem* and the wages for all three would be :

I	II	III
Daily wages	Piece-work doing twice as much of work	Piece-work doing three times as much work
£13 14s 6d	£27 9s 0d	£41 3 6

But as the permanent and temporary labourers also get payment in kind, this must be deducted, otherwise they would receive it twice. After this subtraction the three classes would be paid as follows :

	I Daily wage	II Piece-work doing three times as much work	III Piece-work doing three times as much work
	£ s d	£ s d	£ s d
Permanent labourers:			
Total earnings:	13 14 6	27 9 0	41 3 6
Wages in kind	8 18 5	8 18 5	8 18 5
Wages in cash	4 16 1	18 10 7	32 5 1
Temporary labourers:			
Total earnings	13 14 6	27 9 0	41 3 6
Wages in kind	6 3 6	6 3 6	6 3 6
Wages in cash	7 11 0	21 5 6	35 0 0
Casual labourers:			
Wages in cash, total earnings . .	13 14 6	27 9 0	41 3 6

Thus the daily wages of the three labourers are the same in all cases. Only the amount in cash varies, and the difference is equal to the value of the wages in kind counted once.

From the above the conclusion may be drawn :

1) That the calculation of piece-work must not be based only on the cash wage but on the total wages in cash and kind.

2) That from the total wages the amount given in kind must be subtracted.

Only piece-work paid according to these principles will keep labourers in the country, whilst the system hitherto followed has done much to drive labourers away from the country, as it has been more unfavourable to the permanent hands than to the temporary and casual ones.

773 - **Reclamation and Improvements in the Roman Campagna** (1). — VERRATTI, S. in *L'Italia Agricola*, Year LI, No. 5. Piacenza, May 15, 1914.

A first Commission was appointed in 1870 to report on the measures necessary for reclaiming the Roman Campagna, and in December 1878 a law was passed declaring the proposed reclamation to be of public utility and that the State should undertake the draining of the principal marshes, while landowners should be compelled to do the subsidiary canalization; further, the law decreed that the zone of reclamation was to extend in a circle with a radius of 10 kilometres (6.3 miles) from the *Milliarum Aureum* in the Roman Forum. In July 1883 an additional law was passed enabling the Government to expropriate the owners of land in the given zone should they refuse to play their part in the scheme of reclamation, but as serious outlays were imposed on the landlords without a prospect of anything like adequate returns, and, further, as the expropriation would have involved the State in far too great an expense, the law was applied in three cases only and was then left aside. A new law was finally passed in December 1903 (No. 474), which, together with that of 1883, constitutes the combined law of November 10, 1905 (No. 647), which is still in force.

This law confirms the obligation to reclaim the land in the zone mentioned above, and in that part of the basin of the Aniene which is comprised in the Roman Campagna, with the provision that owners not wishing to conform should have their land sold by public auction, the purchaser undertaking to carry out the necessary improvements. Landlords or purchasers might receive, besides other pecuniary advantages, a loan from the Ministry of Agriculture at 2 ½ per cent, repayable in 45 annual instalments, beginning after the fifth year of the loan, such loans, which might amount to £80 000 per annum, to be furnished by State funds. Even if done by private initiative, three-tenths of the expense of making the subsidiary canalization was to be contributed by the State, the Province and the Commune. With regard to the construction of new roads required by the scheme, these were to be approved by the Ministry of Public Works, and the expense of construction shared equally by the Government and by the Commune, their upkeep being left to the Commune.

A special Commission made up of 11 members was formed to attend to the application of the law and to investigate technical and administrative questions to which it might give rise.

A further law dating from July 1910 (No. 491) comprises some addi-

(1) Throughout this article, "Roman Campagna" is used as a translation of "Agro Romano", that is the territory belonging to the Commune of Rome, and not in the more general sense of all the country round Rome. The Agro Romano includes two very distinct types of country: 1) a flat belt along the coast, originally marshy, including the reclaimed areas of Maccarese, the Isola Sacra, Ostia, etc.; 2) a plain at 200-400 ft., furrowed by streams which mostly only run in rainy weather, and largely under pasture (dry for three months in summer) or temporary grain cultivation: to this second part colonization rather than reclamation applies.

tional measures for reclaiming the Roman Campagna, which may be summarised as follows :

1) *Application of measures laid down in the law of 1905 to land situated beyond the zone originally fixed upon.* — By a Royal Decree it was made possible to extend the application of the measures to land outside the given zone in certain cases where the general condition of an area or the desire to encourage private enterprise made it expedient to do so.

2) *Necessity to encourage the formation and development of centres of habitation in the reclaimed area.* — To this end it was decided: a) that all centres of colonisation consisting of at least 25 families established within ten years of January 1, 1911, and at a distance of at least 5 kilometres (3.1 miles) from the boundaries of Rome, should be exempt from all rates and taxes, local or governmental, during a period of 20 years; b) that anyone proposing to establish such a rural centre of habitation and not having the necessary building land, might apply to the Ministry in order to be supplied with the land by expropriation for the public good; c) that all private or public enterprises, including those started by owners, with the object of establishing rural colonies should be assisted by a loan at 2 ½ per cent. repayable on the terms mentioned above; and d) that the sum required for such loans should be provided by State funds, the total amount being limited to £40 000 per annum beginning from July 1, 1910.

3) *Encouragement of live stock* — The State associated itself with the Province of Rome for the establishment and upkeep of an Institute (Istituto zootecnico laziale) whose duty it is to distribute high class breeding stock suitable to the district, and to encourage the production of forage crops, dairying, etc.

4) *The provision of adequate financial means without creating new charges on the State.* — An independent fund was started known as the "Cassa di colonizzazione per l'Agro Romano" which draws its revenue from the following sources: a) one-tenth of its own net annual profits; b) all sums become available by repayment of capital invested before 1910 or any balance left over in the special budget of the Ministry of Agriculture concerning the reclamation scheme; c) other contributions.

With this fund the Minister of Agriculture will provide prizes and subsidies to encourage useful initiative and especially for making farm roads, providing water supplies for drinking and irrigation purposes, building cottages and other kinds of improvement.

5) *Modifications in certain articles of the law of 1905.* — The period fixed for obtaining the contribution of 30 per cent. from State, Province, or Commune towards canalization works was prorogued to December 31, 1915. The Government was authorised to connect up the farm roads with train or railway stations, where necessary.

Some of the results obtained by the application of the law are given below :

Drainage works carried out by the State. — Of 34 600 acres which are estimated to require draining, about one half have already received attention; large drainage operations have been carried out at Ostia (4686 acres), Isola Sacra (637 acres), Maccarese (10 668 acres), and smaller ones at the Lake of Tartari, in the low ground of the Almone, in the marshes of Stracciacappe, Baccano and Pantano, some of which have already been handed over to associations for management. Up to June 30, 1913, the State had spent about £260 000 on the enterprise. At that time it was estimated that another £80 000 would be required to complete the work, including the running expenses of the machinery for another five years and certain operations to be carried out on the coast between Pratica and Anzio.

The drainage of the Isola Sacra and Maccarese cannot be said to have had practical results in so far as cultivation is concerned, as they both

consist of grazing land over which cattle are allowed to range, and their hygienic condition is not very satisfactory. These areas have recently been brought into the zone of obligatory reclamation.

Drainage Associations. — In April 1912 the 91 Drainage Associations amalgamated to form one central society, which is to reorganize the whole system and undertake the management from a single centralized office, directing all the work and receiving all contributions. A committee made up of delegates from the various constituent societies has already drawn up a scheme of organization for the central office and another relating to the contributions to be paid by the various units. This has already been approved by the general meeting of the delegates and is now only waiting for the approbation of the Ministry of Public Works before being put into practice.

Contributions to subsidiary canalization. — The contribution of 30 per cent. from the State, Province and Commune towards expenses of making the subsidiary canals on the various estates has been granted in twenty holdings at a cost of about £12 800, while grants amounting to £12 000 are being made for six other holdings now carrying out similar work.

Road making. — The law of 1905 provided for the construction of 250 kilometers (156 miles) of roads, but of these only 30 km. (19 miles) have as yet been accomplished at a cost of £41 200, while another 10 km. (6 miles) are being built at a cost of £15 000 and 29 km. (18 miles) are planned at an estimated cost of £60 000.

As the city of Rome has extended, roads which were originally considered to form part of the reclamation zone have been taken over by the city, while the extension of the zone beyond the original limits has increased the number of roads fixed upon in the original plan approved by the Ministry of Public Works in 1905, and for these reasons a Commission has been appointed to modify the original plan. The revised plan is now being passed by the Ministry and provides for 250 kilometers of roads, and above those already in course of construction, at a cost of £460 000 over. Of this it is expected that £180 000 will be spent during the next four years for the building of 100 kilometres (62.5 miles) of road.

Agricultural improvements. — Of the 500 000 acres which constitute the whole Roman Campagna, 175 000 acres have been subjected to compulsory improvement, of which 112 000 acres excluding the suburbs make up the zone fixed by the law of 1903. Of this latter area, 6400 acres are already improved and 54 300 acres are in course of improvement, the remaining 51 000 acres being for the present almost untouched as the "Commissione di vigilanza per l'Agro Romano" admit the great difficulty of carrying the law into effect in all cases. Nothing has yet been done in those areas brought within the limits of the zone in 1910.

Loans. — The adjoining table shows the distribution of the annual grant of £80 000 from the central State bank for loans in connection with agricultural improvements; in ten years about £520 000 have been distributed.

Distribution of loans granted by the Ministry of Agriculture for improving the Roman Campagna.

	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13	1913-14 (1st half year)	Total for the period
	lire	lire	lire	lire	lire	lire	lire	lire
New cottages	292 166	791 725	1 345 376	512 884	881 000	1 078 804	60 209	3 991 164 (\$159 646)
Old cottages repaired	15 373	138 080	187 200	248 217	94 140	159 000	24 000	866 010 (\$34 640)
Farm buildings	358 983	804 640	926 639	898 923	1 273 860	215 836	71 041	1 549 922 (\$61 996)
Farm roads	77 230	124 100	358 930	185 020	246 019	39 050	11 350	1 041 699 (\$47 668)
Land drainage	22 400	47 245	86 255	110 132	248 085	127 000	13 800	654 917 (\$26 196)
Breaking up land	24 502	11 750	69 510	23 500	56 405	7 000	550	193 217 (\$7 728)
Water supply	28 700	20 560	174 336	256 766	242 305	35 200	266 968	1 024 835 (\$40 993)
Plantations	91 455	70 485	140 307	144 803	93 820	8 130	—	549 000 (\$21 960)
Other operations	52 441	49 250	44 847	117 055	90 760	17 765	16 651	388 769 (\$15 550)
Total each year	963 250 (\$38 550)	2 057 735 (\$82 313)	3 333 400 (\$133 336)	2 497 300 (\$99 892)	3 226 394 (\$129 035)	716 785 (\$28 671)	464 569 (\$18 582)	

774 — **Bookkeeping Results: Five-Year Averages obtained at the Accountants' Office of the German Agricultural Society.** — STIEGER. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 255, pp. 87 + 4 tables. Berlin, 1914.

Two years ago Part 180 of the *Arbeiten der D. L. G.* gave the principal average results of five years of bookkeeping in the farms affiliated to the accountants' office of the German Agricultural Society (D. L. G.); these averages are now published annually.

The present work contains the average results of the books kept in 114 farms, classed according to the different regions of the country, for the years 1907-08 to 1911-12. In order to compare these data with each other and to exclude those of the abnormal year 1911-12, the writer adds the averages of the five years 1906-07 to 1910-11 for 103 farms which bear the same numbers in both synopses.

These data are given in the form of tables which contain 71 columns, as follows :

Column 1 : number given to each farm (repeated in column 71.).

Column 2 : group to which the farm belonged according to its extent.

Column 3 : distance of the farm from the nearest railway station.

Column 4 : net returns as ascertained for the purposes of the land tax, given as indications of the quality of the soil.

Column 5 : total value of the farm, which in 48 cases is the value of the farm as established in order to fix the amount of the complementary taxes, in 10 cases the net returns as per land register multiplied by 75, in 14 cases the real purchase price, in 2 cases the value estimated by the "Landschaft" (a Prussian credit institution), in 9 cases the rent capitalized at 3 per cent. plus the value of the live and dead stock, and in 27 cases the value as estimated by the owner himself.

Column 6 : capital invested in buildings

Column 7 : capital in machinery and implements

Column 8 : live stock

} According
to inventory

Column 9 : total live and dead stock in percentage of the whole value of the farm.

Column 10 : total live stock in head of large cattle per 100 hectares (247 acres) of cultivable area.

Column 11 : total draught animals in horse units.

Column 12 : number of draught animals per 100 hectares (247 acres) of cultivable area.

Columns 13 to 20 : the various crops (13, meadows ; 14, permanent pastures, both in percentages of the whole cultivable area ; 15, winter cereals ; 16, spring cereals ; 17, pulse crops ; 18, hoed crops ; 19, forage crops ; 20, bare fallow, (all in percentages of the arable land).

Columns 21-26 : yields in weight of the six most important crops (wheat, rye, barley, oats, sugar-beets, potatoes).

Column 27 : average milk yield per cow and per ration-day.

Column 28 : sale price of the milk.

Column 29 : total yield of the farm ; that is, besides the returns from the sale for cash or credit of the produce, also the value of those articles

supplied to the owner and the increase in value of the inventory at the end of the year.

Column 30: total outlay; that is the total working expenses wages, insurance, outlay other than in cash, such as wear and tear and depreciation of farm implements and other capital, and the decrease in value of the inventory at the end of the year as compared with that at the beginning.

Column 31 shows the difference between the items in columns 29 and 30, which represents the net returns of the farm free from debts, rent or other charges. The net returns per unit of area afford a clear expression of the absolute result of the farm; but if this is to be estimated at its just and full value, it must be examined in connection with other data concerning the same farm. Thus, for instance, the best net return is that obtained with the least expense in the course of the year.

Column 32: shows the amount of expense per unit of net returns. In comparing the results of several farms this figure is not sufficient measure of the success of the farm because it does not take into consideration the value of the farm, and of two farms which, with the same yearly outlay, get the same net returns, the one with the least capital value is to be considered the better managed of the two.

Column 33 shows the net returns expressed as percentage of the value of the farm, that is the interest on the total capital. This figure does not consider the year's expenses, and it is evident that of two farms the net returns of which give the same amount of interest on the total capital, the more successful one is that which obtains this result with the least expense. It thus becomes necessary to take into account the year's expenses as well as the interest on the value of the farm. The easiest way to do so is to add these two quantities together in order to get the total expenses and to obtain the ratio of the net returns to this sum.

Column 34 shows the actual amount of the 4 per cent. interest per unit of surface; then, after having added together, for each farm, the figures contained in columns 30 and 34 in order to have the total amount of expenses, all that remains to be done is to divide by this number the net returns multiplied by one hundred, in order to get the desired number which shows the amount of net returns obtained per cent of total expenses. This figure is found in Column 35.

Column 35: this figure affords the best possible base for judging the quality of the management of a farm from the point of view of profitability. The writer calls it the "fundamental number" (Kernzahl).

Columns 36-41: amounts of the chief partial receipts in cash.

Column 42: total amount of cash receipts.

Columns 49-60: these give the farm expenses (60, the total amount, 49-59 the principal partial amounts).

In Columns 43-48 and 61-70 the quantities contained in columns 36-41 and 49-59 are repeated, but expressed respectively in percentages of the total amount of receipts and in percentages of the total amount of expenses.

The writer gives the averages of the interest obtained by these farms

during the years 1907-8 to 1911-12, first all together and then grouped according to provinces. He then endeavours to determine the influence of the quality of the soil, represented by the amount of the net returns according to the land register, on the economic results of 18 farms in the province of Silesia, and of 21 in the province of Brandenburg. The farms are arranged according to the land register net returns and the writer indicates for each farm: the yield of the crops per unit area, the net returns, the fundamental number (Kernzahl), the outlay for the purchase of artificial manures, the receipts from productive live stock, and the ratio between the areas under the various crops. If for the 21 Brandenburg farms, the first half with average land register net returns of 6s 3d per acre be compared with the other half with average land register net returns of 3s 5d per acre, higher effective net returns will be obtained for the first group than for the second (£1 0s 5d against 11s 5d), although the returns from the various farms taken separately differ considerably. The same result is obtained with the Silesian farms, the two groups of which show respectively land register net returns of 10s 7d and 4s 2d, and effective net returns of £1 9s 11d and 10s 10d per acre. In the same way the fundamental number of the Silesian farms, which is for the two groups 24.80 and 11.56, shows that the better quality of soil allows results to be obtained more economically. The difference between these two numbers is considerably less in Brandenburg (15.21 and 12.24).

At the end of his work, the writer calls attention to the great importance of the value of the farm for all discussions on the management and organization on numerical bases, and on the necessity of a clear understanding as to this value and to the exact method of determining it.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDENT ON PLANT PRODUCTS

775 - **The Electric Field in the Maturation of Wine.** — NITESCU, MARCEL A. in *Revue de Viticulture*, Year XXI, No. 1068, pp. 621-624. Paris, June 4, 1914.

Wine is a good electrical conductor because of the acids and salts it contains, and it has been subjected to the influence of an electric field by CH. HENRY in order to bring about sterilization and maturation. The electric field employed is continuous and of high tension (100 000 volts) but of low intensity, so that the wine should be decomposed as little as possible, though suspended matter and colloids are sufficiently electrified to move towards one of the poles, where they can easily be eliminated. At the same time the inversion of sugar is prevented, and it is thus possible to treat wines attacked by injurious ferments such as "graisse" or "casse".

The Henry method makes it possible to control the process by stopping it as soon as the samples drawn from taps close to the poles have the same flavour as those drawn from the bung hole. The movement of the colloids in the liquid has the further function of constantly stirring the large reaction surface presented by them and thus accelerating their catalysing action.

The different wines, brandies and kirschs which have been treated, yield, besides an appreciable increase of volatile esthers, the various maturation indices which are usually observed as the result of the action of the more slowly working enzymes.

776 - **The Alcohol Content of Yeast.** — FORTH, G. in *Jahrbuch des Vereins der Spiritusfabrikanten in Deutschland*, Vol. XIV, p. 33. Berlin, 1914.

A series of determinations was carried out in the Laboratory of the Society of German Distillers in order to investigate the alcohol content of yeast under various conditions. The results are as follows :

1) The alcohol produced by the fermentation of sugar solutions is not all found in the solution; part is retained by the yeast. Moreover the amount of alcohol in both yeast and solution, stated as per cent. of alcohol + water in both cases, is practically the same and this fact holds good in both weak and strong sugar solutions (10 to 20 per cent.).

2) If yeast be washed to remove the alcohol it contains and then put into a solution containing alcohol, it will absorb alcohol until equilibrium is established between the yeast and the solution.

3) If yeast be left in alcohol solution, the alcohol content of both yeast and solution diminishes owing to assimilation of part of the alcohol.

4) The content of compressed yeast in both water and alcohol increases with the time of keeping, while glycogen disappears simultaneously, from which it would appear that the increase in water and alcohol is due to the decomposition of the glycogen. Moreover the amount of alcohol thus formed is considerably less than the amount expected by the fermentation equation.

777 - **The Use of "Phosphogelose" in Brazil.** — PELLET, H. in *Bulletin de l'Association des chimistes de sucrerie et de distillerie*, Vol. XXXI, No. 11, pp. 849-858. Paris, May 1914.

The "phosphogelose" process in the manufacture of sugar consists in the addition of a mixture of bicalcic phosphate and kieselguhr to the juice previously treated with lime, the object being to help clarification and to obtain a scum of manurial value. The composition of two such scums was as follows :

	Per cent.
Water	43.56 to 43.23
Organic matter	26.32 to 27.67
Total phosphoric acid	8.41 to 9.85

The process is at present in use in a few sugar factories in Bahia.

778 - **The Reduced Gluten Content of Flour.** — BALLAND, J. A. F., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 158, No. 16, pp. 1103-1106. Paris, April 20, 1914.

For some time the Paris bakers have complained that flour requires less water than it did formerly to work up into dough. Analyses from the laboratory of the Bakers' Syndicate show that more than half of the flours examined during the month of February, 1914, contained less than

7.5 per cent. of dry gluten or 22.5 per cent. of moist gluten, a quantity which is considered insufficient to obtain the best results in breadmaking and which is generally attributed to degeneracy of the wheat owing to intensive culture.

From 1869 to 1880 the mean annual content of moist gluten in high class flours from twelve milling firms varied from 27.53 to 30.34, with an average of 29.1 per cent., or 9.7 per cent. of dry gluten. From 1881 to 1895 the figures range from 23.44 to 26.84, with an average of 25.1; during the last ten years (1905-1914) they were further reduced to 21.1, 26.8 and 24.7 respectively. Inferior quality flours frequently only contain 7.5 per cent. of dry gluten.

Although these data are not absolutely comparable owing to the introduction of foreign wheat, they would indicate that since roller mills have supplanted the grist mills, flour has reduced its dry gluten content by 2.2 per cent., that is, every kilog. of flour has lost 22 gms. of protein, which is equivalent to the amount contained in 110 gms. of butcher's meat. On examining the seasonal and regional yield, it was concluded that this loss of gluten is not due solely to degeneration of the wheat, but also to climatic variations and to the new methods of milling which eliminate the germ and those portions of the wheat grain which contain most nitrogen.

INDUSTRIES
DEPENDENT ON
ANIMAL
PRODUCTS

779 - **International Union of Municipal Dairies.** — *Molkerei Zeitung*, Year 28, No. 49, pp. 944-945. Hildesheim, June 26, 1914.

On the occasion of the Sixth International Dairy Congress, at Berne, was held the first general meeting of the recently founded International Union of Municipal Dairies, a large number of municipal dairy enterprises being represented. Stockholm was selected by the meeting as the headquarters of the Union, which has for its object the general advancement of municipal dairying and the advising of its members as to methods of improving their business.

780 - **The Supply of Milk to Indian Cities.** — MANN, H. H. (Agricultural College, Poona) in *The Agricultural Journal of India*, Vol. IX, Part 2, pp. 160-177. Calcutta, April 1914.

An account is given of the milk supply of Poona, this being fairly representative of the conditions existing in several other Indian cities. The milk is produced partly in the city itself and partly in 47 neighbouring villages which send in about 550 galls. per day; of this:

21 per cent.	comes from villages within a radius of less than 3 miles
48 "	" " " " " 3 to 6 "
28.5 "	" " " " " 6 to 9 "
2.5 "	" " " " " over 9 "

Practically the whole supply is brought in by hand in brass pots slung over the shoulders or carried on the heads of the milkmen, bullock carts or the train being only used in a few cases. Nine-tenths of the total consists of buffaloes' milk, whose content of fat and solids-non-fat amounts to 5 and 9 per cent. respectively, as against $3\frac{1}{2}$ and $8\frac{1}{2}$ per cent. in cows' milk.

Of 51 samples collected at the entrance of the city only 10 were pure, even when judged on a very conservative basis, the remainder being adulterated with more than ten per cent. of water. The price varies with the quality, there being a close connection between the price and the amount of water added; for instance all milk sold at less than six seers for one rupee (1s 1d per gallon) is almost certain to be adulterated. With regard to the amount of dirt it contains, this is not nearly so great as would be expected; of the 51 above samples:

56.7	per cent.	were	clean or nearly clean
33.3	"	"	fairly clean
7.8	"	"	distinctly dirty
1.9	"	"	very dirty

The milk produced in the city itself is a far more important contribution to the total supplies than that brought in from the surrounding country. The milking cattle of the city consist of 2 688 head, of which 1532, or 57 per cent., are kept for private use only and 1156, or 43 per cent., for sale of the milk. Among the former class about three-quarters consist of cows and the remainder of buffaloes, while in the latter class the proportions are reversed. The cattle kept for the sale of their milk are housed in small sheds distributed all over the city; 80 per cent. of these sheds contain less than ten animals, and their general conditions of hygiene are very bad. It is estimated that about 2 000 gallons are produced daily, of which about 1 400 gallons are buffaloes' milk and the rest cows' milk; the total daily consumption in the city therefore amounts to 2 550 gallons per day.

The writer discusses schemes of reform for the city milk supplies and advocates the establishment of large dairy farms outside the city, where the animals would be in cheap and natural surroundings, and the organisation of village production and export.

781 - **Experiments with the Biorisator** (1). — WEIGMANN, in *Molkerei Zeitung*, Year 28, No. 46, pp. 885-886; No. 47, pp. 899-901. Hildesheim, June 17 and 19, 1914.

The experiments made by passing several hundred gallons of milk through a Biorisator capable of dealing with 55 galls. of milk per hour have confirmed in the main the conclusions arrived at in former tests. They show further that cheeses made with biorized milk are richer in water and softer than cheeses made at the same time with exactly the same quantity of raw milk. Biorized milk kept good 2 ½ days, while raw milk turned after one day.

Altogether the writer is of opinion that the process is useful, but he recommends that care be taken to prevent new infection of the biorized milk.

(1) See also No. 743, *B.* June 1913; No. 1190, *B.* Oct. 1913; No. 1389, *B.* Dec. 1913; No. 570, *B.* June 1914. (Ed.).

- 782 - **The Action of the Enzymes due to Organisms on the Rind of Hard Cheeses.** — GRAIZ, O. and SZANYI, ST. in *Biochemische Zeitschrift*, Vol. 63, Parts 4, 5 and 6, pp. 436-478. Berlin, June 6, 1914.

Careful examination of the various layers of cheese, starting from the outside and proceeding inwards, leads to the conclusion that in Trappist and Ovar cheeses the enzymes of the flora of the rind have no action on the decomposition of casein and fat in the inside of the cheeses. Further, on theoretical grounds, the possibility of the diffusion of the enzymes from the rind towards the interior must be rejected.

- 783 - **The Preparation of Buffalo Skins for Export from the French Colonies.** — BOULANGER, H. in *Bulletin de l'Office coloniale du Ministère des Colonies*, Year VII, No. 75, pp. 131-144. Melun, March 1914.

It is pointed out that the buffalo skins arriving on the European markets from the French colonies are frequently in a very unsatisfactory condition owing to faulty methods of preparation, and compare unfavourably with similar products from the Dutch Indies, Burma, India and Egypt; certain reforms are advocated.

- 784 - **Agricultural Storehouses in Bavaria (Financial Year 1912-13).** — *Landwirtschaftliches Jahrbuch für Bayern*, Year 4, No. 4, pp. 365-415. Munich, 1914.

The number of agricultural storehouses in Bavaria, in the year 1912-13, was 177, against 169 in the preceding year. The total cost of building and arranging them was in round numbers £193 000. The cereals delivered to the stores amounted to 119 920 tons and those sold to 115 560 tons. In 1900-01 the corresponding figures were 29 728 and 28 522 tons.

Out of these 177 storehouses only 35 are for the exclusive service of the members of the associations that work the storehouse, while the remaining 142 can be used by non-members also. In 135 stores the cereals must be bought at fixed prices, and 23 advance money on cereals. The amount of the loan varies from $33\frac{1}{3}$ to 95 per cent. of the sale price. Some stores, besides purchasing at fixed prices, act as brokers for the sale of cereals, while 23 do not trade at all in cereals. In 32 of these storehouses, storage dues are levied; these range from $2\frac{1}{2}d$ to 10s per ton. For cleaning and grading the grain 83 stores have a scale of charges somewhat higher for non-members than for members. The dues vary from 1s to 12s per ton. Fifty stores grind cereals, at charges ranging from 2s to 20s per ton.

Of the 177 storehouses, 93 are managed by loan banks, 40 by storehouse cooperatives and by purchase and sale associations, 27 by larger federations of associations, 10 by agricultural district associations, 4 by private enterprise and one each by a peasants' association and by a fruit-growers' association.

Besides dealing with the sale of agricultural produce, these storehouses purchase agricultural machines and implements, concentrated foods, seeds, coals and the like.

Eighty-nine of these stores showed a profit at the end of the year and 54 a loss. In the preceding year the figures were respectively 130 and 6.

In 1913 the State granted subventions amounting to £206, and loans bearing 2 per cent interest amounting to £956.

PLANT DISEASES.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

785 - **Leaf-Spot Disease of Sisal in German East Africa.** — BRAUN, K. in *Der Pflanze*, Year X, Part 4, pp. 188-197, plate III. Daressalam, April 1914.

In 1913 leaves of Sisal were found to be more severely attacked than usual by a leaf-spot disease; the spots were sunken and parti-coloured or white; at the time of utilizing the leaves, these spots formed dark masses with difficulty separated from the fibres.

Experiments on the cause of this disease have shown that it may be produced by high temperatures. A temperature of 41° C. for 10 minutes may have a decidedly injurious action, and such temperatures frequently occur in the hot steppes. It is not yet known whether the susceptibility is increased by other factors unfavourable to the plant.

786 - **Researches on Gummosis and the Effects of Frost on Cherry Trees.** — SORAUER, P. in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 2, pp. 253-273 + 2 plates. Berlin, April 6, 1914.

In continuation of previous experiments and researches the writer in 1910 barked a few ungrafted sweet cherry trees (*Prunus avium*) about 20 to 30 years old. On some of the trunks the bark was removed all round, on others only on one side for a length of about 3 feet; in all of them the sapwood was reached. The object of this was to determine whether the irritation caused by the wound was alone the cause of gummosis as is currently believed.

The experiments have proved that the irritation theory, according to which only wounds cause gummosis, is not correct in this form. A wound can certainly produce gummosis, but many wounds are not accompanied by gummosis. On the other hand this disease appears also on spots that have not been in any way wounded.

In the above experiments no centres of gummosis appeared in the wound-callus in the bark. On the other hand such centres appeared in the tissues (and precisely in the recently formed wood) of those portions

of the trunk which were not injured and which were formed, at the same time as the callus tissues, under the old bark. These diseased spots in the wood of recent formation and still in a parenchymatous state grow larger as the distance from the wound increases, but only up to a certain limit, beyond which none are found. In the older annual rings formed before the callus, the disease does not appear at all. The irritation caused by the wound may be considered the sole cause of this.

The wound, according to the writer's observation, causes a considerable afflux of protoplasmic matter towards the tissues that it has laid bare and to the neighbouring parts, which thus acquire the character of young growth necessary for the formation of callus tissue. This flow of protoplasm leads, however, at the same time to an accumulation of the enzymes present in all young tissues; of these, the cytases appear first, while the coagulases increase only gradually.

If these enzymes find their natural employment, as is the case in every young normally growing part of a plant, in which there is a sufficient formation of new cells, no anomalies are caused, and consequently no gummosis spots are produced on the new bark that is formed. In the adjoining parts of the trunk, which have not been deprived of their bark and where the normal pressure of the latter hinders the increase of new cells, an unfavourable ratio is established between the afflux of enzymes and their utilization in the formation of new tissue. The consequent excess of cytases causes outbreaks of gummosis. Near the wound these outbreaks are smaller, because the formation of wood and of new cells increases and the enzymes are utilized to a greater extent. At a certain distance from the wound these effects cease, because the irritation due to the wound is no longer felt. A wound thus causes gummosis only when an unfavourable ratio is set up between the quantities of enzymes flowing towards it and their utilization, thus causing an excess of cytases. This excess of dissolving enzymes prevents the formation of normal cell walls in the cambium tissues, or redissolves those already formed in the older tissues; in this case the cytases proceeding from the inside of the cell towards the outside cause the dissolution of the secondary membrane, and the result is gummosis.

This unfavourable ratio between the hydrolizing and coagulating enzymes appears not only in cases of traumatic origin but often in uninjured tissues. Thus the writer was able to prove the presence of gummosis in the vegetative cone of completely sound twigs. The contours of wounds are the spots on which these ruptures of enzyme equilibrium more frequently occur. It is not the wound in itself that determines gummosis.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

787 - **New Fungi.** — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 195-204. Berlin, 1914.

This (twelfth) report gives descriptions of one genus and 32 species of fungi new to Science, collected at various times and in various countries.

They include the following: *Hemileia Holarrhenae* on leaves of *Holarrhena antidysenterica* in Eastern India; *Aecidium parile* on leaves of *Loranthus* sp., which is itself parasitic on *Goniothalamus Elmeri*, in the Philippines; *Entyloma Oryzae* on rice leaves in the Philippines; *Meliola Memecyli* on leaves of *Memecylon edule* in Eastern India; *Cercospora Artocarpi* on leaves of *Artocarpus indica* in the Philippines; *C. Canavaliae* on leaves of *Canavalia ensiformis* in the Philippines; *C. pachyderma* on leaves of *Dioscorea alata* in the Philippines; *C. Puerariae* on leaves of *Pueraria phaseoloides* in the Philippines.

788 - **Contribution to the Mycological Flora of the Tyrol and Istria.** — BUBÁK, FR. in *Annales Mycologici*, Vol. XII, No. 2, pp. 205-220, plate VIII. Berlin, 1914.

Among fungi collected in the Tyrol and Istria in 1912 and 1913, the following occurrences are noteworthy:

Melampsora Lini (D. C.) Tul., which produces rust of cultivated flax, on *Linum angustifolium* in Istria.

Rehmiellopsis conigena Bubák (new) on the apophyses of the cone-scales of *Pinus halepensis* and *P. Pinea* in the Tyrol.

Ceuthospora phacidoides (Grev.) var. *Oleae* Scalia in olive groves in the Tyrol.

Cycloconium oleaginum Cast., so far only known from olive (on which it produces the leaf-spot disease known in Italy as "olive pox" or "peacock's-eye"), has now been found in the Tyrol on *Phillyrea latifolia* (Oleaceae).

Cladosporium episclerotiale Bubák (new) on sclerotia of *Sclerotinia cinerea* Schröt. (producing brown-rot of stone fruits) from mummified plums, in the Tyrol.

789 - **Parasitic Fungi from Northern Japan** (1). — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 158-165, 1 fig. Berlin, 1914.

This second contribution to the parasitic fungus-flora of Northern Japan includes 55 species, viz. Uredineae, 33; Ustilagineae, 1; Phycomycetes, 2; Ascomycetes, 7; Fungi Imperfecti, 12. Most of these were collected in 1913; one genus and eight species are new.

The following are of special interest:

Puccinia triticina Eriks. on *Triticum vulgare* L.

Uropyxis Fraxini (Kom.) P. Magn., on *Fraxinus longicuspis* Sieb. et Zucc., new for Japan.

Gymnosporangium Yamadae Miyabe: aecidia on leaves of *Pyrus Malus* L., teleutospores on branches of *Juniperus chinensis* L. (2).

Phytophthora infestans (Mont.) De Bary, on *Solanum Melongena* L.

Mycosphaerella Yamadae Syd. (considered by Salmon as a variety of *M. Alni*), on leaves of *Hovenia dulcis* Thunb.

Cystotheca lanestris (Harkn.) Sacc., on *Quercus glandulifera* Bl.

(1) See also No. 608, B. Feb. 1911; No. 994, B. March 1911; No. 1529, B. May 1911. (Ed.)

(2) See No. 481, B. May 1914 and No. 578, B. June 1914. (Ed.)

Discosia maculiformis Syd. (new), on living leaves of *Fagus sylvatica* L. var. *Sieboldi* Maxim.

Clasterosporium degenerans Syd. (new), on living leaves of *Prunus Mume* Sieb. et Zucc. (1).

790 - **Parasitic Fungi from Formosa.** — SYDOW, H. and P., in *Annales Mycologici*, Vol. XII, No. 2, pp. 105-112. Berlin, 1914.

The fungus flora of Formosa was previously quite unknown. The writers now record 50 parasitic fungi collected there between 1905 and 1914; they include: Uredineae, 44 (13 new); Phycomycetes, 1; Ascomycetes, 2; Deuteromycetes, 3 (2 new).

The following species occurring on cultivated plants may be mentioned:

Kuehneola Fici (Cast.) Butl., on leaves of fig (*Ficus Carica* L.), *Broussonetia papyrifera* (L.) Vent. and white mulberry (*Morus alba* L.).

Ochropsora Sorbi Diet., on leaves of *Pyrus sinensis* Lindl.

Phleospora Mori (Lév.) Sacc., on leaves of *Morus alba*.

RESISTANT PLANTS

791 - **Resistance of Potatoes to Blight (*Phytophthora infestans*) in New Zealand.** — HILL, W. S., in *The Journal of Agriculture*, Vol. VIII, No. 4, pp. 370-371, 1 fig. Wellington, N. Z., 1914.

At the experimental farm at Mounahaki it has been observed that the potato Gamekeeper is very resistant to the disease (*Phytophthora infestans*), while Up-to-date growing beside it suffers severely. The former seems to be well adapted to the light soil and damp climate of the locality.

MEANS OF PREVENTION AND CONTROL

792 - **Commercial Sulphate of Copper and the Determination of the Copper in it.** — MACH, F. and LEDERLE, P. in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIV, Part 1-2, pp. 129-143. Berlin, April 14, 1914.⁽¹⁾

The writers examined five samples of sulphate of copper (one from Switzerland, two from Germany, one from Belgium and one from England) at the Agricultural Experiment Station of Augustenberg, Baden; they observed a difference in the behaviour of the samples when crystals of equal weight were dissolved in distilled water at room temperature. The crystals of two samples took 90 minutes to dissolve, two others 120 minutes and one 85. When these crystals were ground, no difference in the time required for their solution was observed. In the preparation of Bordeaux mixtures with these solutions, after standing one hour some differences were noticed, which on standing longer almost completely disappeared. On adding to 100 gallons of these mixtures 1 lb. of sugar they all behaved completely alike, precipitating but little and showing also after standing a length of time the same slimy consistence. The writers come to the conclusion that as far as their practical use is concerned the samples examined all have the same value.

As large well coloured crystals cannot, without further examination, be considered pure (they may, for instance, contain sulphate of manganese) the writers consider a qualitative analysis to be indispensable.

For the determination of the copper content they adopted R. Win-

(1) See No. 581, B. March 1912.

disch's method with sodium hypophosphite, and the method proposed by Rhead and recommended by Moser with titanium trichloride. The first method almost always gave somewhat too low values; it is suitable only where the saving of time is a consideration, while the titanium trichloride method gives very reliable values.

793 - **Comparative Spraying Experiments with Several Fungicides against Vine Mildew.** — BRETSCHNEIDER, A. in *Zeitschrift für das landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 3-4, pp. 106-118. Vienna, March-April 1914.

In 1913 experiments on the control of vine mildew (*Plasmopara viticola*) were made in various parts of Austria, Bordeaux mixture being compared with the following commercial fungicides: "Antiperonospora" (2 per cent.), "Cupran" (1, 2 and 3 per cent.), "Cuprosulfid" ($\frac{1}{2}$, 1 and 2 per cent.), "Forhin" (1 and 2 per cent.), "Kupferchlorid" (1, 2 and 3 per cent., apparently identical with the "Pasta Caffaro" long used with success in Italy), "Perocid" ("Cerdidyum sulfat", 1, 2 and 3 per cent.), and lime-sulphur wash (1:30 and 1:40).

These fungicides have also been tried in some places against mildew of Cucurbitaceae (*Pseudoperonospora cubensis*) and certain fungi affecting fruit trees (*Fusicladium*, *Monilia*, *Sphaerotheca*, etc.).

The adhesiveness of the various mixtures was generally good; as for the visibility of the sprayed foliage, it was best with "Perocid" and Bordeaux mixture and sufficiently good with the other mixtures, with the exception of "Cupran". For rapidity of preparation, all the fungicides, with the exception of copper sulphate and "Perocid", dissolve rapidly. "Cupran" and "Kupferchlorid" dissolve without leaving any residue. "Forhin" leaves a little and "Antiperonospora" rather more. "Cuprosulfid" settles very rapidly. "Cupran", "Kupferchlorid" and "Perocid" have a neutral reaction, "Cuprosulfid" and "Antiperonospora" have a slightly acid one, and "Forhin" is very acid. With the exception of "Cupran" and "Antiperonospora" none of the mixtures clog the sprayers. "Cuprosulfid" and "Antiperonospora" cause considerable scorching of the foliage, "Cupran" and "Forhin" (one case) also, but in a lesser degree. The other fungicides, including the two sulphur preparations, are harmless.

As regards the fungicidal power of the several preparations, the writer observes that the results of the experiments have only a relative value, because in 1913 only few localities were visited by a severe attack of mildew. In the scale of efficiency the first place is held by Bordeaux mixture; next in order of merit are: "Forhin" (which proved very good), "Perocid" (sufficiently effective in 3 per cent. solution), "Kupferchlorid" (effective but must be applied in 3 per cent. solution); then "Antiperonospora" (which did not completely prevent the appearance of mildew) and last of all "Cupran" and "Cuprosulfid", which failed completely. It was not possible to judge the effect of the lime-sulphur wash, because where it was tried mildew had scarcely shown itself.

Against *Pseudoperonospora cubensis* all the fungicides that were tested proved unavailing.

The effect of the above fungicides in the control of the fungi of fruit trees could not be ascertained; further experiments are necessary. "Antipernospora", "Cuprosulfid" and "Cupran" are not to be taken into consideration, as they cause scorching even on apple trees.

The fungicides which deserve being considered in practical work for the control of mildew are: "Forhin" (which must be placed on the market with a more constant composition), "Kupferchlorid" (which is now sold in the form of paste, like the "Pasta Caffaro," because under the form of powder it has not been satisfactory), and "Perocid". The latter especially seems to have a future before it, because it costs much less than Bordeaux mixture; the other two fungicides cost about the same and approach more the price of Bordeaux mixture.

BACTERIAL
AND FUNGOID
DISEASES OF
VARIOUS CROPS

794 - **The Control of Damping-off Disease in Plant Beds.** — JOHNSON, JAMES, in *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* 31, pp. 29-67, figs. 1-12. Madison, Wis., March 1914.

Damping-off of tobacco seedlings in Wisconsin is generally produced by either *Pythium De Baryanum* Hesse or some species of *Rhizoctonia*. These two fungi can live on a great variety of hosts, as well as on organic matter in the soil.

The special points in the control of damping-off requiring further study were: 1) the strength of formalin sufficient to give complete control; 2) the relative value of other fungicides; 3) the value and practicability of steam sterilization of soils in the field.

In studying these points, tobacco and cress (*Lepidium sativum*) were grown in boxes in untreated soil, in sterilized soil inoculated with the organisms and in uninoculated sterilized soil, the various treatments being applied to the re-inoculated soils.

It was found that 1-100 formalin did not kill the fungus, though it kept it in check for some time. Treating the soil with 1-50 formalin, at the rate of two quarts per square foot of soil, will kill the fungi which cause damping-off, and hence will prevent the outbreak of the disease even under the weather conditions most favourable for its appearance. Formalin treatment has the further advantages of exerting a slight stimulating action on plant growth and of killing some weed seeds; but the formalin costs a good deal and takes some time to act, while the soil dries out slowly after treatment.

Sterilization of the soil by heat has proved the most satisfactory method of preventing damping-off from all standpoints, except that under certain conditions it may be more expensive than formalin treatment. Where a steam traction-engine can be obtained, the sterilization is best performed by introducing steam under pressure from the engine below a galvanized iron pan inverted over the seedbed; the edges of the pan should be driven into the soil an inch or so, and the steam applied for half an hour or an hour. Sterilization by heat has the further advantage of killing all weed seeds and insect pests, and of giving greatly increased vigor and growth of the plants sown afterwards.

795 — **The 1914 Outbreak of Rust on Winter Grain in Bavaria.** — HILTNER, L. in *Wochenblatt des Landwirtschaftlichen Vereins in Bayern*, 1914, No. 25.

In many parts of Bavaria rust on wheat and rye was so abundant in the summer as to cause general alarm. The attacks are almost all due to *Puccinia glumarum*, *P. triticina* being only occasionally associated with it.

As the ears were particularly badly attacked, total losses of crop were feared by the farmers; but the writer points out that the experience of 1904 and 1911 shows that even a bad attack of yellow rust in the ears may result in nothing worse than some diminution of yield.

In previous outbreaks the following points were observed. In wheat, the local varieties are particularly subject to severe attacks of yellow rust (*P. glumarum*), whilst most other varieties, in particular the pedigree ones, remain nearly free. Many of the latter were, however, attacked by black rust (*P. triticina*), from about the middle of June, but without much damage being done. Yellow rust, which is often called spring rust, may appear as early as the end of April, as it did this year. In rye no marked distinctions between varieties as to rust-resistance have been observed.

There is a general consensus of opinion that rust is much favoured by one-sided nitrogenous manuring, especially with nitrate of soda; this observation was, however, made before much care was taken to distinguish the different kinds of rust. In 1904 and this year (1914) it was found that yellow rust was less severe on fields properly manured, even when the dressing included sulphate of ammonia or nitrate, than on unmanured land; also that thin crops were far more severely attacked than an even crop covering the ground properly. Unbalanced nitrogenous manuring is, however, favourable to yellow rust also, while dressings of phosphates have a marked effect in preventing rust; cereals following a green manure crop are also very little subject to rust.

The true cause of severe outbreaks of rust is certainly the state of the weather. This year, just as in 1904, the outbreak was induced by the fact that in April a number of hot days were followed by frosts or heavy dews: then a spell of cool weather checked the growth of the crops, so making them very susceptible. The local varieties, which grow very quickly in spring, were the most severely attacked. Mists seem also very favourable to the spread of rust. The first reports of rust came from the same place each year, no doubt showing that the conditions there were suitable for an early outbreak, and confirming the importance of atmospheric conditions.

The writer suggests the advisability of making a comparative enquiry throughout Europe on the appearance of rust in its connection with varieties, soil, weather, etc., with a view to finding out the conditions leading to epidemics of this disease.

796 - **A Fungus Disease of Peppers (*Capsicum* spp.): *Colletotrichum nigrum*.** — BANCROFT, C. K. in *The Journal of the Board of Agriculture in British Guiana*, Vol. VII, No. 3, pp. 139-140. Demerara, 1914.

In 1913 the fruits of various peppers (*Capsicum*) in the experimental area of the Botanic Garden at Georgetown were attacked by a disease which spread so fast that some plants lost all their crop. The disease appears first in the form of spots at the apex or on the sides of the fruit; these generally form when the fruit is half-grown. Concentric circles then form round the point of infection, and eventually the whole fruit may become involved, or may fall off. On the affected parts the fruit bodies of a fungus have been found: this has been identified as *Colletotrichum nigrum* Ellis et Halsted.

The fungus appears also to make its way down the stems for some distance.

Some varieties of pepper, such as Long White and Long Red, seem to be very subject to the disease, while others are less attacked; Red Chilly and Long Bird seem to be quite immune.

The treatment adopted was to cut back the infected plants and spray with Bordeaux mixture: after the last spraying few fruits were attacked.

INSECT PESTS.

GENERALITIES

797 - **The Scale Insects of British Guiana.** — BODKIN, G. E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 3, pp. 106-124. Demerara, 1914.

In British Guiana scale insects are the worst enemies of cultivated plants; in general they are known as "blight".

The following species, being widely distributed and attacking a great number of cultivated plants, are to be considered as highly injurious: *Aspidiotus destructor*, *Lepidosaphes beckii*, *Ischnaspis longirostris*, *Pseudococcus citri* and *Saissetia nigra*.

A number of species attack ornamental plants (in particular orchids and ferns) in sheltered places; others, again, are constantly associated with certain crops, as *Aulacaspis rosæ* on mango and *Ripersia* sp. on sugarcane.

Many species are undoubtedly indigenous, while others have been introduced, especially from the West Indies, with fruits and provisions. A notable absence is that of *Diaspis* (*Aulacaspis*) *pentagona*, which is common throughout the West Indies. Certain well-known species, such as *Aspidiotus destructor* and *Vinsonia stellifera*, occur on trees and orchids in the virgin forests of the interior, while the most isolated native plantations are always found to harbour scales.

A number of natural enemies are known in the Colony. Besides some undetermined Hymenoptera, they include: *Blastobasis lecaniella* Busck, *Vitula bodkini* Dyar and *V. toboga* Dyar, Lepidoptera whose larvae feed on *Saissetia nigra*, *S. oleæ*, *S. hemisphaerica* and *Ceroplastes floridensis*; *Cryptognatha nodiceps* Mshl., *Azia trinitatis* Mshl. and *A. pontibrianti* Muls. (Coccinellidae), of which the first two attack *Aspidiotus destructor*

and the third *Saissetia hemisphaerica*; certain Neuroptera; and lastly two fungi — *Sphaerostilbe coccophila* (red-headed fungus) attacking chiefly *Chionaspis citri*, and *Cephalosporium Lecanii* (shield-scale fungus) attacking *Saissetia nigra*, *S. oleae*, *S. hemisphaerica*, *Coccus mangiferae* and *C. hesperidum*.

The following fifty-one species have so far been recorded from British Guiana :

Chionaspis citri Comstock (orange snow-scale), common on the trunks and branches of *Citrus* trees and on castor-oil.

Howardia biclavis Comstock, common on branches of jasmine (*Tabernaemontana Wallichiana*).

H. biclavis var. *detecta* Maskell, rare on branches of *Sapium Jenmanni*, a native rubber plant.

Diaspis boisduvalii Sign., frequent on shoots of plantains and on the orchid *Cattleya superba*.

D. echinocacti opuntiae Ckll., recorded in 1893 and 1899 on *Opuntia elongata*, but not observed since.

Aulacaspis rosae Bouché (mango snow-scale), common on leaves of mango and cinnamon.

Hemichionaspis minor Mask., not uncommon on cotton.

Pinnaspis buxi Bouché, common on leaves of ornamental palms and other plants.

Aspidiotus cydoniae Comstock, occasional on the stems of eggplants.

A. destructor Sign., abundant and injurious to coconut, banana, almond tree (*Terminalia Catappa*), avocado, etc.

A. diffinis Newstead, described from Demerara in 1893, but not found since in the Colony.

A. sacchari Ckll., sometimes common on sugarcane.

Morganella longispina Morgan, described from Demerara in 1889, on *Cupania sapida*, but not found since.

Selenaspidus articulatus Morgan (West Indian red scale), common on *Citrus* and leaves of Liberian coffee.

Chrysomphalus aonidum L. (red-spotted scale), frequent on leaves of *Citrus*.

C. aurantii Mask., rare on *Citrus*.

C. biformis Ckll., common on leaves of many orchids and on young sisal plants.

C. dictyospermi Morgan, described from Demerara in 1889, but not reported since.

C. dictyospermi var. *pinnaulifera* Mask., recorded on crotons (*Cordiaecum*) at Demerara in 1893, but not found since.

C. dictyospermi var. *arecae* Newst., described from Demerara in 1893, but not found since.

C. personatus Comstock, common on leaves of star-apple (*Chrysophyllum Cainito*), ornamental palms and mangoes; occasional on leaves of Para rubber (*Hevea brasiliensis*).

Lepidosaphes beckii Newm. (orange mussel-scale), one of the commonest

- in British Guiana, occurring on *Citrus*, *Codiaeum*, Barbados cherry (*Malpighia glabra*), etc.
- L. pinnaeformis* Bouché, recorded from Demerara in 1892, but not reported since.
- Ischnaspis longirostris* Sign., frequent on leaves of Liberian coffee, to which it is very injurious, and on ornamental palms.
- Parlatoria zizyphus* Lucas, occasional on leaves of *Citrus*.
- Orthesia insignis* Douglas, common and very injurious on various Composites and *Citrus*.
- O. praelonga* Douglas (croton bug), fairly common on crotons (*Codiaeum* spp.), mango, Barbados cherry, sugarcane, *Sapium Jenmanni*, etc.
- Asterolecanium bambusae* Bdv., common on bamboos.
- A. fimbriatum* Fonsc., recorded from Demerara in 1889, but not found since.
- A. pustulans* Ckll., common on leaves of orchids and akee (*Blighia sapida*); occasionally damages Para rubber.
- Lecaniodiaspis dendrobii* Douglas, described from Demerara in 1892 on *Dendrobium* and *Codiaeum*, but not reported since.
- Ceroputo harberi* Ckll., reported on *Schinus terebinthifolius*.
- Pseudococcus citri* Risso (common mealy bug), very common on *Citrus*, cacao, ferns, *Codiaeum* and rice; rare on sugarcane.
- P. nipae* Mask., occasional on coconut and other palms.
- P. virgatus* Ckll., occasional on egg-plant.
- Ripersia* sp. (sugarcane mealy bug), common on leaves of sugarcane.
- Tachardia lacca* Kerr. (the Indian scale producing lake), recorded in 1890 on *Erythroxylum Coca* in the Botanic Garden at Georgetown, but apparently now extinct.
- Pulvinaria* sp., rare on leaves of sugarcane.
- P. pyriformis* Ckll. (mealy shield-scale), common on guava, avocado and ornamental plants.
- P. simulans* Ckll., recorded on *Licuala grandis*.
- Ceroplastes denudatus* Ckll., recorded in 1893 on *Codiaeum*, but not found since.
- C. dugesii* Towns, recorded on *Schinus terebinthifolius*.
- C. floridensis* Comst. (Florida wax-scale), common on limes and various ferns.
- Vinsonia stellifera* Westw. (glassy star-scale), very common on leaves of coconut and other ornamental plants, on French cashew (*Eugenia Jambolana*), *Citrus*, and various forest trees of the interior.
- Eucalymnales perforatus* Newst. (tesselated shield-scale), occasional on leaves of coconut and French cashew.
- Coccus hesperidum* L. (common shield-scale), common on *Citrus* and Liberian coffee.
- C. mangiferae* Green (mango shield-scale), common on leaves of jasmine (*Eugenia paniculata*) and mango.
- Saissetia begoniae* Douglas, described in 1892 on begonias, but not found since.

- S. hemisphaerica* Targ. (brown shield-scale), common on Liberian coffee, *Citrus*, guava, various ferns, etc.
S. nigra, Nietn. (hibiscus shield-scale), very common on *Sapium Jenmanni*, Para rubber, ochroe (*Hibiscus esculentus*), *Codiaeum* sp., egg-plant, cotton, sunflower and various ornamental plants.
S. oleae Bern., common on *Citrus*, *Duranta* and various ornamental plants.

798 - **Injurious Scales from the Seychelles.** — GREEN, E. ERNEST, in *The Journal of Economic Biology*, Vol. 9, No 1, pp. 47-48. London, 1914.

In a small collection of injurious insects from the Seychelles, the following scales have been determined.

Aspidiotus ficus Ashm., on leaves of *Zamia* sp. (Cycadaceae), much grown for ornament in tropical countries.

A. bromeliae Newst., on leaves of pineapple. The discovery of this species is interesting, as it was previously only known from examples found on pineapples on sale in England, probably from the Canaries. The amount of infection appears to show that it may do a good deal of damage.

Lecanium hesperidum L. and *L. tessellatum* Sign., on leaves of water hyacinth (*Eichhornia crassipes* = *E. speciosa*). As this plant is very harmful in blocking canals and rivers (1), the scales must be considered useful in this case.

L. hemisphaericum Targ., on leaves of *Justicia Gendarussa*. Many species of the genus *Justicia* are shrubs with very ornamental flowers; they seem to be particularly subject to the attacks of scales, in Ceylon chiefly *Orthezia insignis*. *L. hemisphaericum* is a cosmopolitan species, attacking almost all plants except Coniferae and Gramineae.

799 - **Experimental Demonstration of a Difference in Biological Race between the Phylloxera of the South of France and that of Lorraine: *Peritymbia (Phylloxera) vitifolii pervastatrix*.** — BÖRNER, CARL, in *Zeitschrift für angewandte Entomologie*, Vol. I, Part I, pp. 59-67. Berlin, 1914.

As the writer had previously observed differences between the behaviour of the phylloxera of Villers l'Orme (Lorraine) and that of the South of France towards certain varieties and species of vines, he proposed to determine by means of experiments with both kinds of phylloxera whether the differences observed were due to a difference of race or to the different climate or nutrition of the insect. With this object in view, American vines and their hybrids with European vines were infected with phylloxera from Lorraine at Villers l'Orme, while in a French vineyard at Pagny-sur-Moselle (near the frontier) gall-producing phylloxera brought expressly from the south of France were used. The vines came from the same mother plants, were of the same age and had all been grown in Lorraine. Any difference in the susceptibility to attacks in vines of the same variety could thus be due only to some biological difference in the phylloxera used to infect them.

The experiments showed that biological differences really exist and

(1) See No. 333, B. April 1913.

reveal themselves in the repulsion shown by the phylloxera of Lorraine to certain vines which are attacked by the French phylloxera. The writer therefore considers the Lorraine phylloxera as a distinct race (the *Pervastatrix* race).

Among the results of the experiments the following are to be mentioned. At Villers l'Orme the following varieties inoculated with Lorraine phylloxera proved completely immune and showed no galls on the leaves or nodules on the roots: Riparia Gloire de Montpellier, Riparia \times Rupestris 107 Geisenheim, Riparia \times Rupestris 3306 and 3309 Couderc, Riparia \times Chasselas 24 Laquenese, Cordifolia \times Rupestris 19 Geisenheim. Isolated small fertile galls together with sterile galls and punctures and occasionally small nodosities were found on Aramon \times Rupestris Ganzin No. 1. A regular formation of larger or small nodosities, together with the absence of leaf galls, was shown by Riparia \times Rupestris 175 Geisenheim, Riparia \times Rupestris 101-14 Richter, and Riparia \times Cunningham 535 Oberlin.

These varieties all showed normal formation of galls and root nodosities when inoculated with phylloxera from the South of France, with the exception of Aramon \times Rupestris Gauzin No. 1, which behaved in the same way to both races (1).

Whether the *Pervastatrix* race has arisen through adaptation to European vines or already existed in America on the *Labrusca* vines so closely allied to European vines, has not yet been decided. Apparently climate has not had any noticeable influence on its development.

Notwithstanding the very numerous infection experiments made under varying conditions, it has never been possible to get the *Pervastatrix* race to adapt itself to one of the completely immune vines; it may therefore be assumed that it is impossible for the *Pervastatrix* race to readapt itself from its usual host plants (European and *Labrusca* vines) to plants immune from its punctures, because on the latter it dies.

In the cross between immune and susceptible vines, immunity apparently behaves as a dominant character.

Inoculations of immune vines with root phylloxera coming from Alsace, Württemberg and Saxony have never led to infection, so it may be concluded that the *Pervastatrix* race has a wide distribution in Germany.

The writer divides the vines so far examined as to their behaviour towards the *Pervastatrix* race into the four following groups:

1. *Immune vines*, embracing many pure races of *Vitis riparia* (*vulpina*), as well as *V. rubra* and the races of *V. Berlandieri*; then a number of hybrids, for instance Riparia \times Rupestris Couderc 3306 and 3309, Geisenheim 107, Cabernet \times Rupestris 33 a 1, Cordifolia \times Rupestris Geisenheim 19 and 20, Hybrid Frane, Hybrid Dromois.

(1) Recently vines which had proved immune to the *pervastatrix* phylloxera after repeated inoculations (1912 and 1913), were inoculated with phylloxera from the South of France and immediately showed the formation of root nodosities.

2. *Vines subject to attack.*

a) Vines slightly attacked, generally quite free after the winter (resistant vines). To this group belong the following: Aramon \times Rupestris Ganzin No. 1, Mourvèdre \times Rupestris 1202, Aramon \times Riparia Teleky 143 B, Riparia \times Gamay Oberlin 595 and 604.

b) Vines which permanently show leaf galls (mostly sterile) and root nodosities, but which for the most part are resistant: Riparia \times Rupestris 101-14, Riparia \times Vinifera 44 Laquenesey, Madeleine royal \times Riparia 33 Laquenesey.

c) Normally attacked vines (fertile galls and root nodosities), susceptible to permanent infection, and easily attacked: *Vitis vinifera* and *V. silvestris* (European vines); then *V. Labrusca* with its hybrids, and the American vines; *V. arizonica*, *V. Berlandieri*, *V. cordifolia*, *V. monticola*, *V. palmata*, *V. rupestris* and *V. Solonis*. This group also includes several Asiatic vines and numerous hybrids: Berlandieri \times Riparia, Rupestris \times Vinifera, Riparia \times Labrusca, etc.

According to the writer it would be strongly advisable to impose the greatest limitation on the introduction of foreign vines into Germany, on account of the danger of introducing the phylloxera from the South of Europe.

800 - **Hymenoptera Parasitic on *Aphis euonymi*, the Beet Aphis (1).** — MALAQUIN, A., and MORTÉ, A., in *Comptes rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXVI, No. 16, pp. 803-805. Paris, 1914.

MEANS OF
PREVENTION
AND CONTROL

So far seventeen species of Hymenoptera have been found to parasitize *Aphis euonymi*. They are as follows:

Aphidinae: gen. *Praon* (one sp. near *P. abjectus* Halid.); gen. *Trioxys* (*T. auctus* Hald., *T. heraclei* Hald.); gen. *Aphidius* (*A. crepidis* Hald., *A. urticae* Hald. and two others).

Proctotrupidae: gen. *Lygocerus* (*L. antennalis* Kief., *L. rufipes* Thoms.); gen. *Scelolima* (two undetermined species).

Cynipidae: gen. *Allothia* (*A. minuta* Hart. and two other spp. undetermined); gen. *Alloxysta* (*A. crassa* Cam.).

Chalcididae: gen. *Encyrtus* (one sp. undetermined); gen. *Pteromalus* (one sp. undetermined).

The two commonest species are *Trioxys auctus* and *Aphidius crepidis*. They attack chiefly apterous individuals of the aphid, laying one egg in each; the act of oviposition takes two or three seconds. The parasitized aphid shows no unusual symptoms for three or four days, and if not adult continues to grow and complete its metamorphosis; after this it becomes sluggish, turns from black to pale olive-green and finally to brown, swells up and dies. The dead body is almost spherical and adheres to the leaf by means of a sticky liquid, thus presenting a very characteristic appearance.

T. auctus takes three weeks to develop, while the aphid requires fifteen to eighteen days, according to the weather; other parasites (*Aphidius*, *Encyrtus*) take about as long as *Trioxys*.

(1) See also No. 296, B. March 1914.

In autumn, the latest Hymenoptera deposit their eggs in the sexual female aphids, then living on spindle (*Euonymus europaeus*). The females pass the winter on the twigs, and the Hymenoptera emerge from the parasitized ones towards the end of March or in early April; the healthy *Aphis euonymi* appear early in March.

The pupa of *Trioxys* within the aphid is protected by a white silky covering, whereas that of *Allotria* is covered only by the empty skin of its host.

As showing the importance of these parasites, the writers refer to the two following cases of infection:

a) On the 9th and 19th of June, 1913, twenty individuals of *Trioxys auctus* of both sexes were liberated in a breeding-cage containing two beets whose leaves were infested by about a thousand aphids; on the 2nd of July more than 500 showed the characteristic appearance of being parasitized.

b) In a small garden, plants of *Euonymus*, beets, *Lysimachia vulgaris*, *Epilobium angustifolium*, thistles, etc., were covered with aphids; at the beginning of July some thousand individuals of *Trioxys auctus* and *Aphidius crepidis* were liberated: by the 15th of August it was almost impossible to find a living and healthy aphid; some stems of beets for seed showed over 300 parasitized aphids.

801 - **New Species of *Aphelinus* Parasitic on Injurious Aphids in Russia** (1).

— KURDJUMOV, N. B., in *Revue Russe d'Entomologie*, 1913, Vol. XIII, No. 2, pp. 266-270. St. Petersburg, 1913.

Four new species of *Aphelinus* (Chalcididae) have been bred from injurious aphids at the Poltava Experiment Station. They are as follows: *A. toxopteraphidis* and *A. flavipes* from *Toxoptera graminum* Rond.; *A. hordei* from *Brachycolus noxius* Mordw.; and *A. atriplicis* from *Aphis chenopodii* Schrank. (*A. atriplicis* L.).

802 - **Two New Genera of Hymenoptera Parasitic on *Ectoedemia***. — ROHWER

S. A., in *Psyche*, Vol. XXI, No. 2, pp. 79-81, figs. 1-2. Boston, Mass., 1914.

The writer describes two new genera of Hymenoptera, *Anomopteris* and *Centistidea*, each represented by a single species; these genera belong to the sub-family *Liophroninae*, and come near *Centistes*.

Anomopteris fasciipennis is parasitic on *Ectoedemia phloeophaga* Busck, and *Centistidea ectoedemiae* on *E. castaneae* Busck, both of which are injurious to sweet chestnuts in Virginia.

803 - ***Remigia repanda* (Lepidoptera), injurious to Crops in Sao Paulo, Brazil.**

— HEMPEL, ADOLPHO, and D'UTRIA, GUSTAVO, in *O Fazendeiro*, Year VII, No. 3, pp. 110-111. São Paulo, 1914.

Remigia repanda is widely spread in the State of São Paulo; its larvae are very voracious and feed chiefly on Gramineae, in particular maize, rice and sugarcane. The moth has a number of broods in the year.

(1) See also No. 294, B. March 1914.

(Ed.).

To prevent attacks, one measure is to burn off the vegetation of waste places, in which the eggs are laid.

If a crop is attacked, aceto-arsenite of copper may be used as a spray (2 lbs. per 100 gallons of water, with the addition of 2 lbs. of soap and 4 lbs. of sugar, or 1 gallon of molasses, to make it stick). For grass crops 1 lb. per 100 galls. is enough. In some cases it may be worth while to burn off a crop and plough it under, so as to destroy the larvae and pupae and prevent subsequent attacks.

To stop the larvae spreading, trenches may be dug round the centres of infection. A belt of quicklime on the ground will also stop them.

Many birds are useful in destroying these larvae.

804 - **The Lesser Bud-Moth (*Recurvaria nanella*) on Apples in Michigan.**

— SCOTT, E. W., and PAINE, J. H., in *Journal of Agricultural Research*, Vol. II. No. 2, pp. 161-162. Washington, D. C., 1914.

In the spring of 1912, during spraying experiments on apples at Benton Harbour, Scott noticed serious damage caused by small larvae to the buds of unsprayed trees; in one neglected plantation in the neighbourhood, the insect was largely responsible for a complete loss of crop. The damage was attributed at the time to the eye-spotted bud moth (*Imetocera ocellana* Schiff.).

In 1913 the life-history was followed out; various differences were found between the insect from Benton Harbour and *T. ocellana*. On examining the adults, A. C. Busck referred them to *Recurvaria crataegella*, described by him in 1903; further research by Busck and the writers has shown that this is identical with the European *R. nanella* Hüb. (known as the lesser bud-moth), so that *R. crataegella* is to be considered a synonym of this.

European authorities had recorded this species on apple, pear, apricot, peach, cherry and plum. According to Staudinger and Rebel (1901), the distribution in Europe is: C. Europe, Sweden, N. Spain, S. France, C. and N. Italy, Dalmatia and S. W. Russia.

805 - ***Coccus citricola*, a New Scale infesting Citrus Trees in California.** —

CAMPBELL, ROY E. in *Entomological News*, No. 5, pp. 222-224. Philadelphia, 1914.

In 1909 a scale was found on citrus trees at Claremont which appeared to differ from the common *Coccus hesperidum* L.; it was first referred to *C. longulus* Dong. and then to *C. elongatus* Sign., but the writer has recently determined it to be a new species, which he names *C. citricola*.

It is so far known only from leaves and branches of *Citrus*. The young scales mostly settle down on the leaves, but when half grown they migrate to the twigs. None have been found on branches more than half an inch in diameter, and they are confined to the lower branches. When the scales are abundant, as often happens, they fit over one another in a characteristic way, like tiles.

The insect has recently become much more abundant, and has been found in many fresh localities in Southern California, in the Lower San Joaquin valley and to a slight extent in the Sacramento valley. It has probably existed for some time in California, and may very likely have been confused with *C. hesperidum*.

The writer gives the systematic and biological characters distinguishing *C. citricola* from *C. hesperidum* and *C. elongatus*.

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